MACHINERY

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Ingenious Equipment Used in Making Split Bushings at a Ford "Hydro" Plant

By CHARLES H. WICK

IN the countryside surrounding the vast Rouge plant of the Ford industrial empire are twenty "Hydro" factories that supply small parts, tools, and gages required for the mass production of automobiles. Each of these plants obtains a substantial portion of its electrical requirements from water power. One plant, located at Northville, Mich., is compactly designed and conveyorized to produce the total Ford requirements for valve guide bushings—approximately 5,000,000 per month. Details of the unusual manufacturing methods and ingenious machinery used in producing split type valve guide bushings are described in this article.

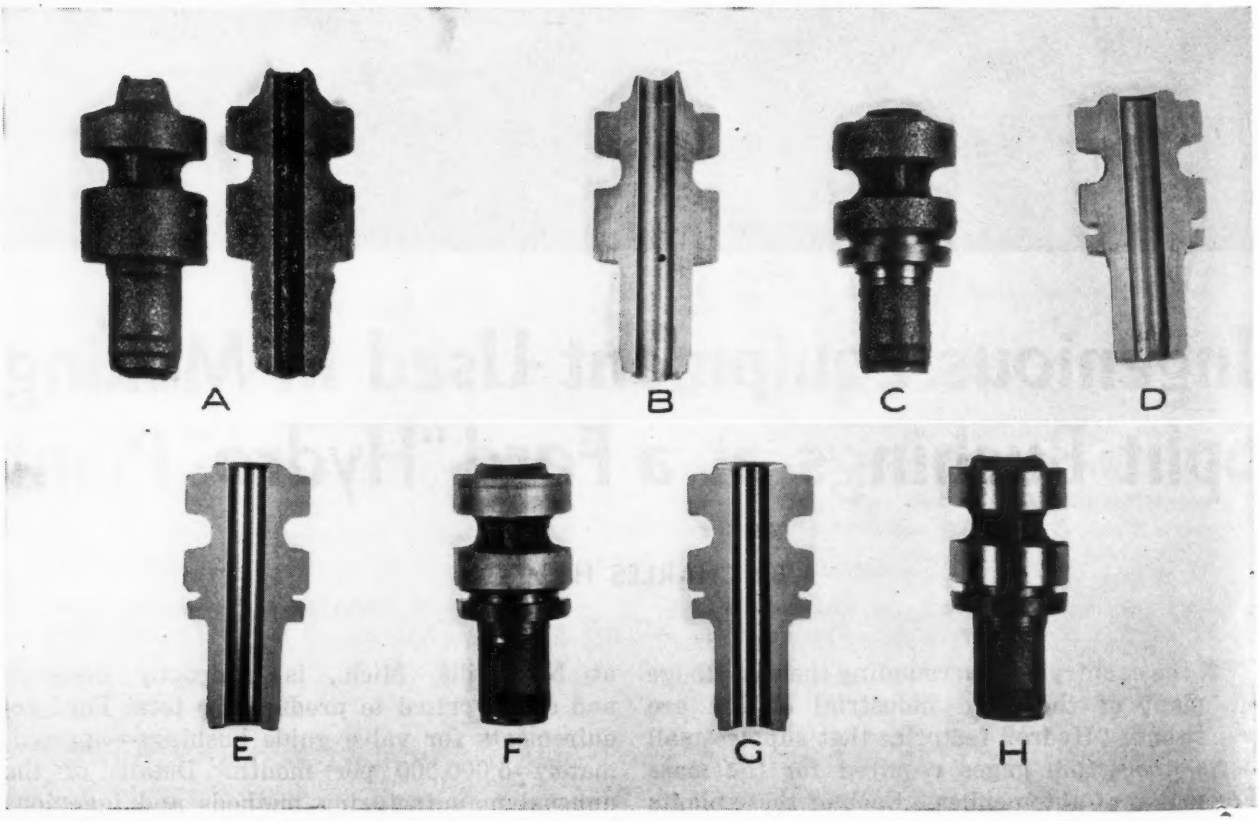
The cast halves of the split type valve guide bushings shown at *A* in Fig. 1 are snag ground on a pedestal grinding machine to remove any burrs or other surface irregularities resulting from the casting operation. The mating faces and trenches or inner grooves of these parts are then rough-broached. Following this operation the part has the appearance shown at *B*.

Approximately 1/16 inch is removed from both face and groove in this operation, which is performed on ten special Ford-built broaching machines like that shown in Fig. 2. Parts from the casting supply bins are carried to the hopper shown at the far end of the machine by pivoted buckets that travel on an overhead chain conveyor. Each part is nested in one of nineteen bushing carriers mounted on the endless chain of the broaching machine. One of the two sprockets on which this chain turns is driven by a worm and gear from a 5-H.P. motor. The nineteen carriers are gibbed to align with ways while carrying the parts under the broach heads. A spring-actuated pressure pad in the top of the fixture aligns and holds the parts against the broach blades.

The traveling chain pulls the carriers beneath the broaches at the rate of 43.2 feet per minute, resulting in an hourly production of 1560 half bushings. The two broaches, which are shown removed and lying on their side in their holders, are provided with copper-brazed, tungsten-carbide inserted teeth, spaced 0.5315 inch apart. The twenty-eight teeth are ground with a 5-degree hook angle, a 2-degree back-off angle, no land, a 0.09 inch radius, and are 0.18 inch deep. The teeth for cutting the groove progressively change from a square cross-section, with small rounded corners, to a hemisphere, each tooth being designed to remove 0.007 inch of stock.

A pump, which is chain-driven from the same motor that drives the endless chain of the broaching machine, supplies mineral oil as a coolant for the operation. The broached parts fall from the carriers into the container shown in the foreground as the chain turns around the driving sprocket. Here they are inspected for

Fig. 1. Progressive Steps in Producing the Finished Valve Guide Bushing Shown at H from the Split Casting Seen at A



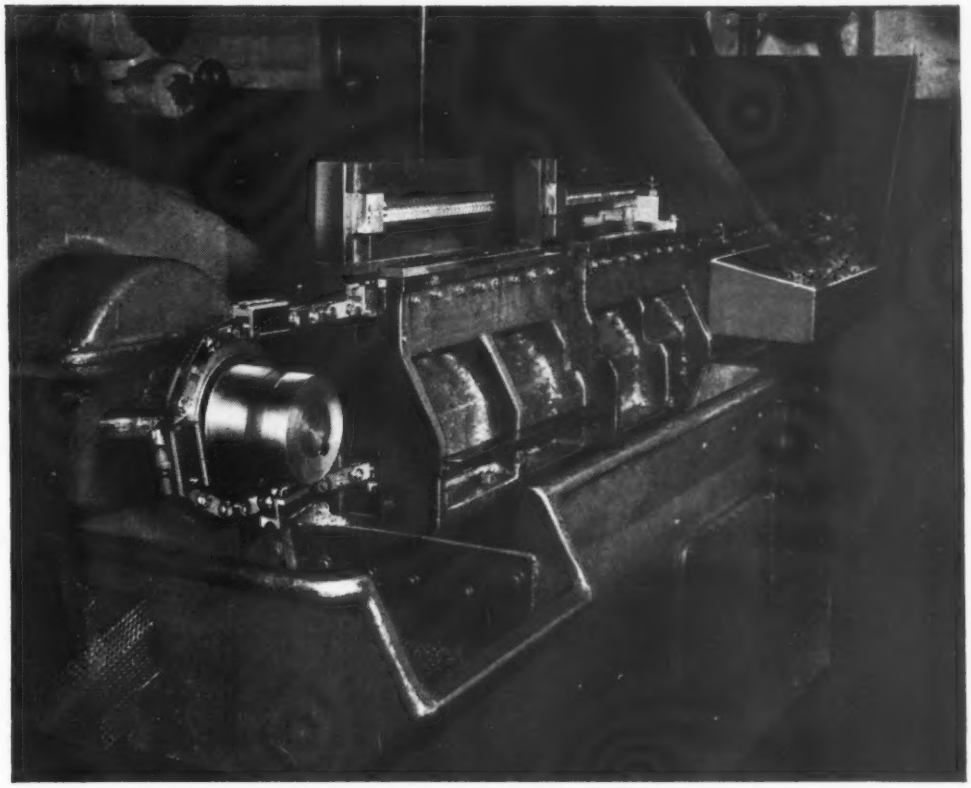


Fig. 2. Special Horizontal Broaching Machine Designed to Cut Inner Groove and Faces of the Bushing Casting. Following This Operation the Part Appears as Shown at B in Fig. 1

foundry defects which may have been uncovered in the broaching operation, and are assembled in pairs in special stock trays that hold sixty-three sets of parts, arranged in nine rows of seven per row.

The trays are passed through a degreaser to remove the chips and coolant from the broaching operation. Then a groove, the ends, and the outside diameter and face of a collar of the paired valve guide bushings are turned at a rate of 1700 bushings per hour on special six-spindle Baird vertical chucking machines. This operation forms the parts as shown at *C* in Fig. 1. A battery of these automatic continuous turning machines is shown in the heading illustration.

The stock trays are placed on the table of the machine, as shown in Fig. 3, where they are periodically indexed longitudinally by the cam-operated dogs shown in contact with the trays in the foreground. One of two cam-operated arms, each provided with a two-fingered chuck, picks up a machined pair of parts from one spindle chuck and deposits it in the stock tray shown at the left. Simultaneously, the other arm lifts an unmachined pair of parts from the tray at the right and places it in a spindle chuck that has been emptied during the previous indexing. The spindle chucks are rotated at 490 R.P.M., and the six spindles or turret are indexed about the center line of the machine at 3 R.P.M. Maximum cutting speed is 130 surface feet per minute.

A close-up view of the tooling, which is identical for each spindle, is shown in Fig. 5. The two tools mounted in the tool-block at the right of the spindle turn the groove, which is approximately 1/8 inch deep, and the outer periphery and face of the shoulder. The two tools mounted in the left-hand tool-block finish-turn the outside diameter of the shoulder and chamfer the groove. Both right- and left-hand tool-blocks, with their four cutting tools, are moved in the path of an arc, toward and away from the work, at the rate of 0.0041 inch per revolution, by means of cams mounted at the top of the machine.

Located directly below each chuck is a 30-degree counterboring tool which is fed vertically upward at 0.0042 inch per revolution to chamfer and face one end of the bushing. On separate spindles directly above each part are spot-facing tools with floating pilots that face the other ends of the bushings. These tools are fed vertically downward at 0.0029 inch per revolution. The floating pilots, which are 0.002 inch smaller in

Fig. 3. The Two Cam-actuated Arms of This Six-spindle Continuous Machine Automatically Load and Unload the Rotating and Indexing Chucks

diameter than the bore of the bushing, enter and align the split parts before they are clamped.

The cam and lever arrangement seen under the table of the machine in Fig. 4 actuates the loading and unloading arms, the two-fingered chucks on these arms, the longitudinal indexing of the stock trays, and the three-jaw spindle chucks that clamp the bushing pairs together during the turning operation. The trays are indexed a distance equal to the center distance between the rows in the stock trays after each row has been completed.

The bushing pairs are then separated and carried by conveyor to special Ex-Cell-O lapping machines, as shown in Fig. 6. Each bushing half is placed face down in a plate containing sixteen slots, which rotates the parts over a 24-inch diameter lapping wheel at a speed of 4 R.P.M. From 0.001 to 0.002 inch of stock is lapped from the inner face of the half bushing during a single revolution over the lapping wheel. Cam- and spring-actuated pressure pads hold the parts firmly in contact with the lapping wheel, which is rotated at 400 R.P.M. by a 5-H.P. motor. A production of 1125 parts per hour is attained. The parts are automatically ejected through a chute into the work basket seen in the foreground. Then the parts are cleaned again by passing through a degreaser to remove lapping compound and emery.

The lapped face of the bushing is burnished and the groove is semi-finished by broaching on machines similar to those used for rough-broaching. The number and design of the broach blade teeth

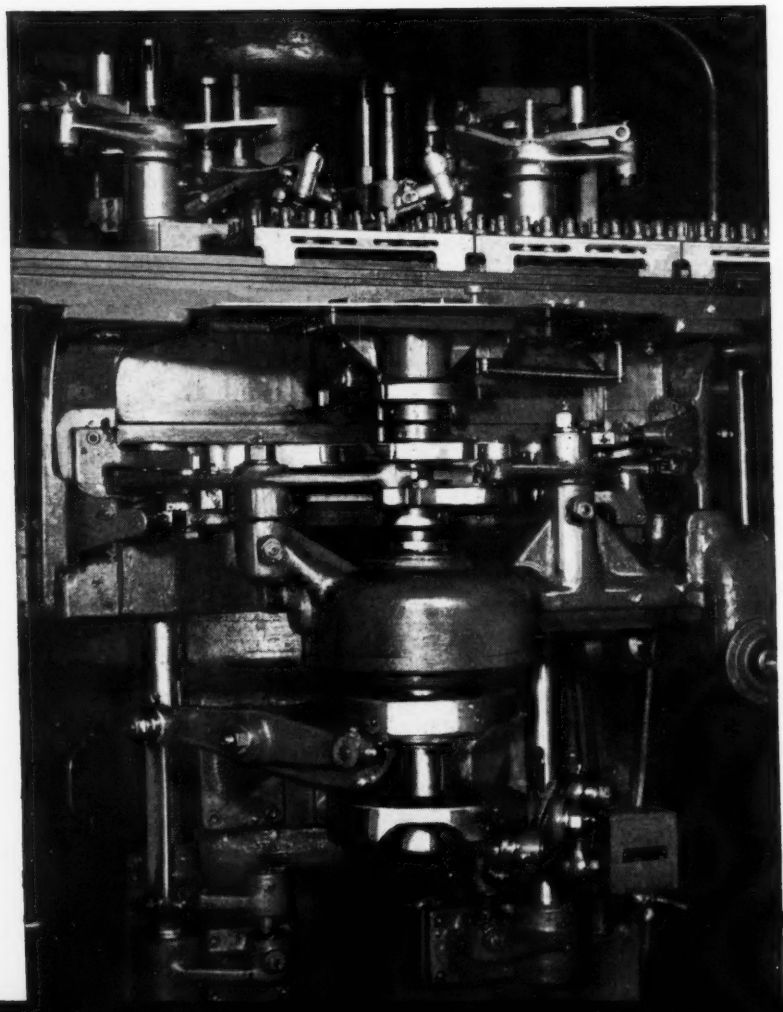


Fig. 4. Machine Shown in Fig. 3 with Cover at Front Removed to Show Cams that Actuate Loading and Unloading Arms, Chucks, and Stock Trays

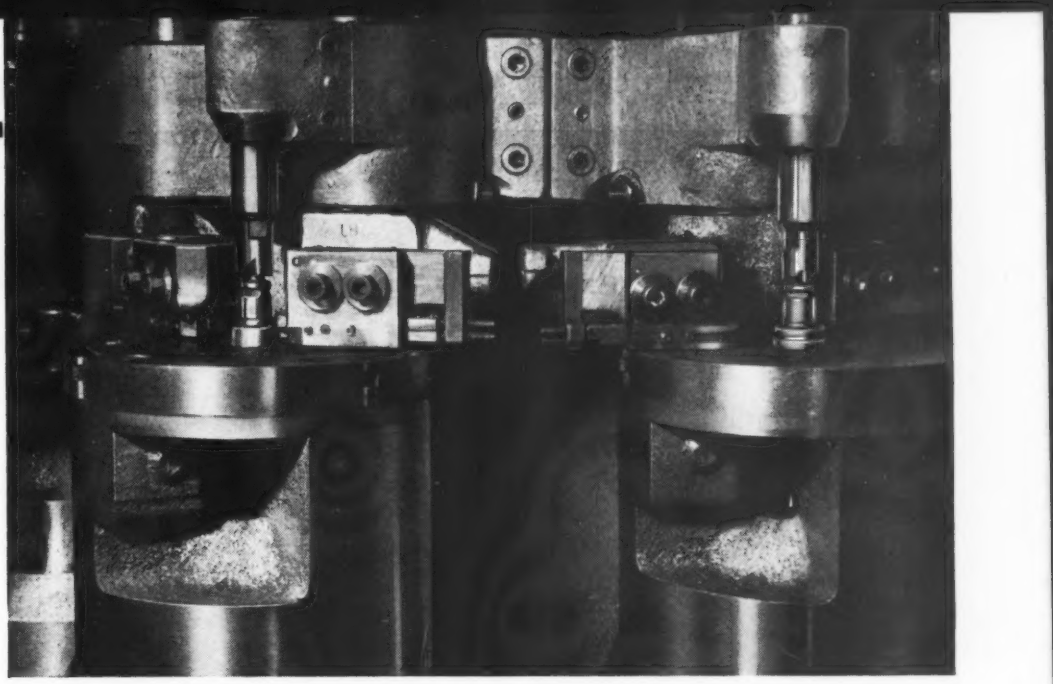


Fig. 5. Tooling for Turning the Groove, Shoulder, and Ends of the Valve Guide Bushing. The Tooling is Identical on All Six Spindles

for semi-finishing the groove are the same as for roughing, but only 0.015 inch of stock is removed, in increments of approximately 0.0007 inch. Also, the last five teeth are of the same size and do not have any hook. The groove radius is increased from 0.135 to 0.150 inch in this operation. Flat-land broach blades with teeth all the same size, between which the groove broach blade is held, are used to provide smooth finished surfaces on the inner face by compressing the outer layers of the metal.

The outer periphery of the bushing halves is then semi-finished as shown at *F* in Fig. 1 by broaching. Semicircular, outside-diameter broach blades, mounted on special broaching machines similar to those used for machining the mating faces and grooves of these parts, are used for this operation. Approximately 0.020 inch of stock is removed from each surface.

The parts are then paired and inserted in stock trays. The inside diameter of the bushing pairs is then reamed to finish size (from 0.313 to 0.314 inch) as shown at *G* in Fig. 1. A special straight-shank reamer, guided by a pilot, is used to obtain this smooth finish. A flat relief or clearance is provided on the teeth at the front of the reamer, but an eccentric relief, which provides a lapping effect on the bore of the part, is ground on the teeth at the rear of the reamer.

The parts are kept in pairs following the reaming operation, and are mounted on arbors by means of motor-driven bench fixtures for finish-grinding the outside diameter. This dimension is held to a total tolerance of 0.0005 inch,

Fig. 6. For Lapping the Inner Faces of the Bushing Halves, the Parts are Held on a Slotted Plate and Rotated over an Abrasive Wheel

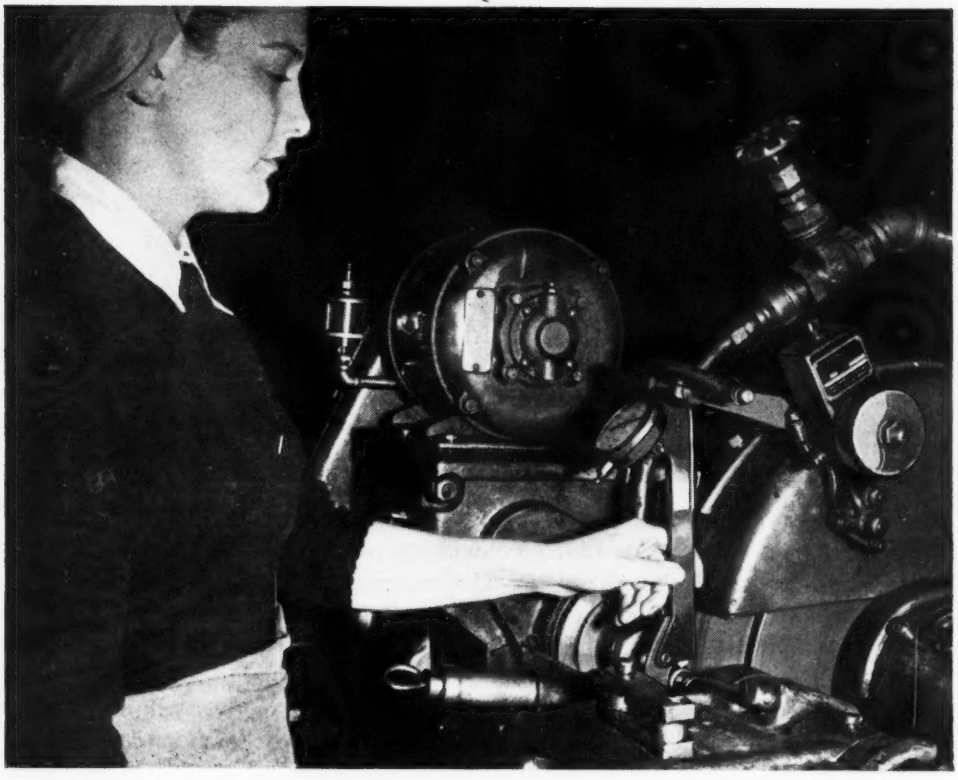


Fig. 7. The Outside Diameter of Paired Bushing Halves is Finished to a Tolerance of 0.0005 Inch on This Cylindrical Grinding Machine with Automatic Work Sizing Gage

and must be concentric with the bore to 0.0015 inch total indicator reading. Approximately 0.010 inch is removed from the diameter on automatic and semi-automatic cylindrical grinders, such as that shown in Fig. 7, equipped with automatic work sizing gages. The arbor, with bushing, is rotated at 100 R.P.M., and the grinding wheel at 2300 R.P.M. The production is 200 bushings per hour per grinding machine.

At the end of this operation, the bushings are removed from the arbors, but are still kept paired. They are then given a final washing, 100 per cent inspection, and are shipped to assembly plants and dealers.

An interesting feature of this installation is a centralized coolant clarifier and temperature regulator. The system is so designed that individual pumps are not required on the machines. The coolant drains from the thirty-six grinding and ten lapping machines through trenches under the floor to a centrally located sump. From the sump, all coolant, sludge, abrasive particles, etc., are pumped to a Hoffman coolant clarifier. This machine has an internal, continuous conveyor which scrapes the bottom of the tank and removes the heavy sludge and mud from the coolant. The remainder is pumped into the floatation chamber where air agitation causes the coolant to foam. This foam, containing the dirt, rises to the surface of the coolant, and is allowed to overflow into a dirt chamber.

The clean coolant is drawn from the bottom of the floatation chamber into a clean storage tank, where its temperature is regulated to 92 degrees F. It is then recirculated by central pumps to the individual machines. The system handles approximately 300 gallons of coolant per minute, and about six tons of sludge is removed per week. Approximately 200 gallons of coolant is lost per day through evaporation.

Graphical Method of Determining Size of Round Blanks

By DR. G. A. LARRI

THE method to be described provides a convenient means of determining the diameter of a blank for a round drawn shell where the contour of the drawn shell is such as to make mathematical calculation of the blank diameter somewhat difficult. The method is applicable in cases where the thickness of the blank remains constant and also in cases where a variation in thickness occurs during the drawing operation.

The accuracy of the method is dependent only on the accuracy of the graphical construction, since the theory of the graphical solution exactly corresponds to the mathematical method customarily used for calculating blank sizes. The procedure is as follows:

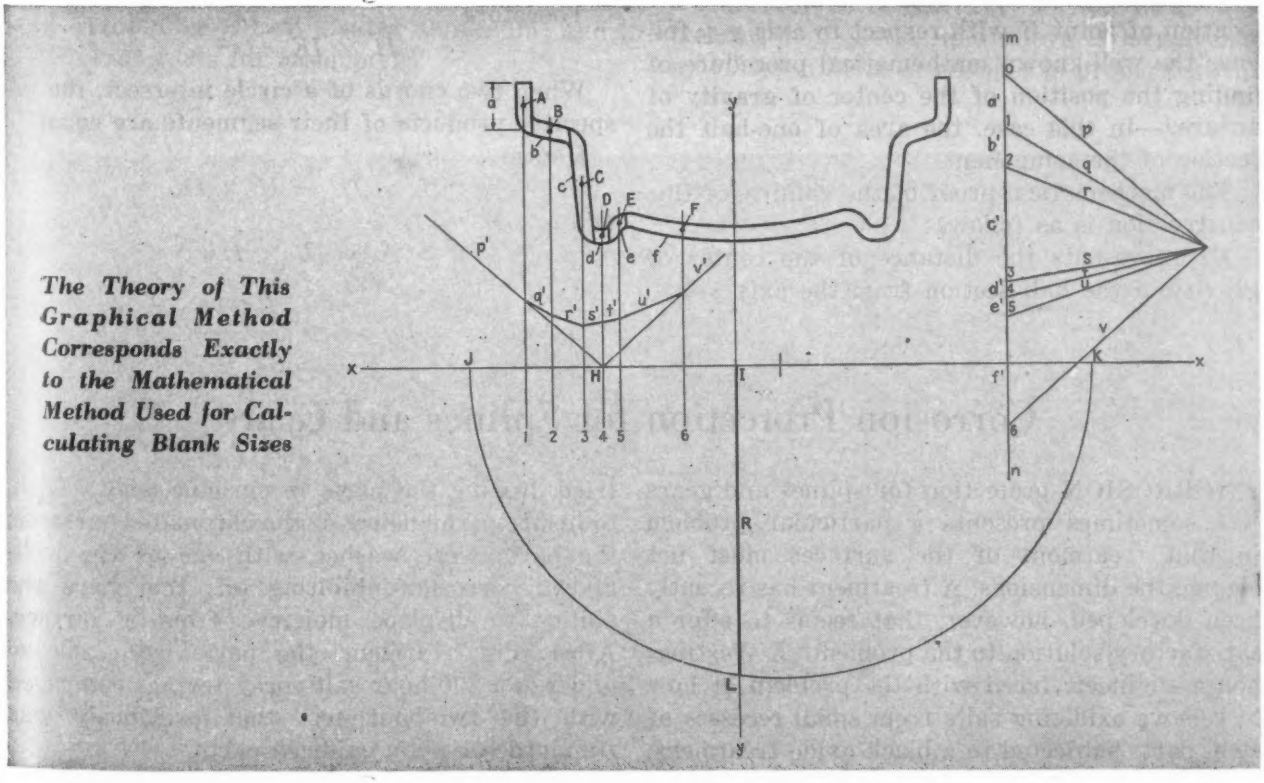
1. Draw a section of the required shell to a scale enlarged as much as is practicable. The shell section shown in the accompanying diagram is that of a wheel of a toy train. The axis of the wheel is indicated by *y–y*.

2. Divide one-half the section into elements *a*, *b*, *c*, etc., of such length that each can be considered to be straight and of uniform thickness without appreciable error.

3. Mark the position of the center of gravity of each element (points *A*, *B*, *C*, *D*, etc.). As the elements are practically straight and of uniform thickness, they are rectangular or nearly so, and the position of the center of gravity of each can be easily determined.

4. Through each of the points *A*, *B*, *C*, *D*, *E*, and *F* draw a line parallel to axis *y–y*.

5. Draw a line *mn* parallel to axis *y–y* and on it mark in succession the length of each element if they are of the same thickness as the blank, labeling them *a′*, *b′*, *c′*, etc. If they are not of the same thickness as the blank, their lengths as marked out on line *mn* are increased or decreased in proportion to the change in thickness. Thus, if the thickness of a given section has been reduced to one-half that of the original blank thickness, the length of the corresponding element as marked out on *mn* should be reduced by one-half. The successive points on line *mn* are then indicated as *0*, *1*, *2*, *3*, *4*, *5*, and *6*.



The Theory of This Graphical Method Corresponds Exactly to the Mathematical Method Used for Calculating Blank Sizes

6. From the extreme points *0* and *6* draw two converging lines at an angle of approximately 45 degrees with line *mn*. Connect the point of intersection of these two lines with the points *1*, *2*, *3*, *4*, and *5* on line *mn*. Label these converging lines successively *p*, *q*, *r*, *s*, *t*, *u*, and *v*.

7. Now draw a line *p'* parallel with line *p* so that it intersects line *1* which passes through point *A*. From the point of intersection of line *p'* and line *1*, draw a line *q'* parallel with line *q* so that it intersects line *2*. From this point of intersection on line *2* draw a line *r'* parallel with line *r* until it intersects line *3*. Similarly, line *s'* is drawn parallel with line *s*, *t'* with *t*, *u'* with *u*, and *v'* with *v*. Lines *p'* and *v'* are then extended until they intersect, forming point *H*. (In the diagram, point *H* happens to fall on line *4*, but this is coincidental.)

8. Through point *H* draw line *xx* perpendicular to axis *y–y*. Label the point of intersection *I*. Locate point *J* on *xx* so that $HJ = HI$, and locate point *K* on *xx* so that *IK* = the distance *0–6* on line *mn*.

9. Draw a semicircle with *JK* as the diameter. Designate the point where this semicircle cuts *y–y* as *L*.

The radius of the blank then will be equal to *IL*.

This geometric construction to determine the location of point *H* with respect to axis *y–y* follows the well-known mathematical procedure of finding the position of the center of gravity of an area—in this case, the area of one-half the section of the component.

The mathematical proof of the validity of this construction is as follows:

HI represents the distance of the center of gravity of the half-section from the axis *y–y*.

Length *0–6* multiplied by the thickness *t* of the blank represents the area of half the section.

By the theorem of Pappas and Guldinus, the volume of a body generated by rotating a plane section about an axis lying in the same plane of the section is given by the formula:

$$V_s = 2\pi \times S \times A$$

where

V_s = volume of drawn shell;

S = distance of center of gravity of section from axis of rotation; and

A = area of section.

Applying this formula to the accompanying diagram:

$$V_b = 2\pi \times HI \times (0\text{–}6 \times t)$$

If r = radius of blank required, the volume V_b of the blank is:

$$V_b = \pi r^2 t$$

Since the volume of the blank must equal the volume of the finished shell,

$$V_s = V_b$$

and

$$2\pi \times HI \times (0\text{–}6 \times t) = \pi r^2 t$$

or

$$2HI \times 0\text{–}6 = r^2$$

By construction, $JI = 2HI$ and $IK = 0\text{–}6$. Therefore

$$JI \times IK = r^2$$

When two chords of a circle intersect, the respective products of their segments are equal. Hence

$$IL \times IL = JI \times IK$$

and

$$r^2 = IL \times IL$$

$$r = IL$$

Corrosion Protection for Splines and Gears

CORROSION protection for splines and gears sometimes presents a particular problem in that treatment of the surfaces must not change the dimensions. A treatment has recently been developed, however, that seems to offer a satisfactory solution to the problem. A Westinghouse engineer, faced with the problem of how to remove oxidizing salts from small recesses of steel parts subjected to a black oxide treatment, tried dipping the parts in chromic acid. Then, to insure permanency of the chromated surfaces, the parts were washed with one of the well-known corrosion-inhibiting oils that have the ability to displace moisture from a surface. After this treatment, the parts were able to undergo a 200-hour salt spray test, as compared with the two-hour test that previously was standard for plain oxidized parts.

Sub-Zero Temperatures in Treating and Assembling Metal Parts

Sub-Zero Temperatures are Used to Further Harden Steels after Heat-Treatment, to Retard Age-Hardening of Aluminum, to Shrink-Fit Parts for Assembly, and to Cool Tools During Metal-Cutting Operations

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WITH the critical shortage of steel (particularly of the high-alloy types) resulting from the war, many users of tool steels have resorted to various ways of making their active tools usable as long as possible. The sub-zero treatment of metals, which for years received little attention, has been thoroughly investigated and revised. These investigations disclosed that cold-treatment can be used to increase the hardness of steels after heat-treatment and thereby to increase the life of cutting tools; to cool tools during metal-cutting operations; to eliminate progressive size change, growth, or distortion of metal parts; to retard age-hardening of heat-treated aluminum; and to shrink-fit parts for assembly.

Years before extreme sub-zero temperatures were available, the stabilizing of machine tool castings was done by leaving them out of doors for a long period of time. Being exposed to the elements one or more seasons, they were subjected to some zero or sub-zero temperatures, and this, followed by summer tempering, was often enough to produce the required degree of dimensional stability. Even the early precision gage-blocks made prior to World War I, and then famous as the ultimate in accuracy, were apparently seasoned this way without resorting to any "artificial" low temperatures.

The very early literature on low-temperature treatment of metals and alloys is largely made up of descriptions of changes in properties which

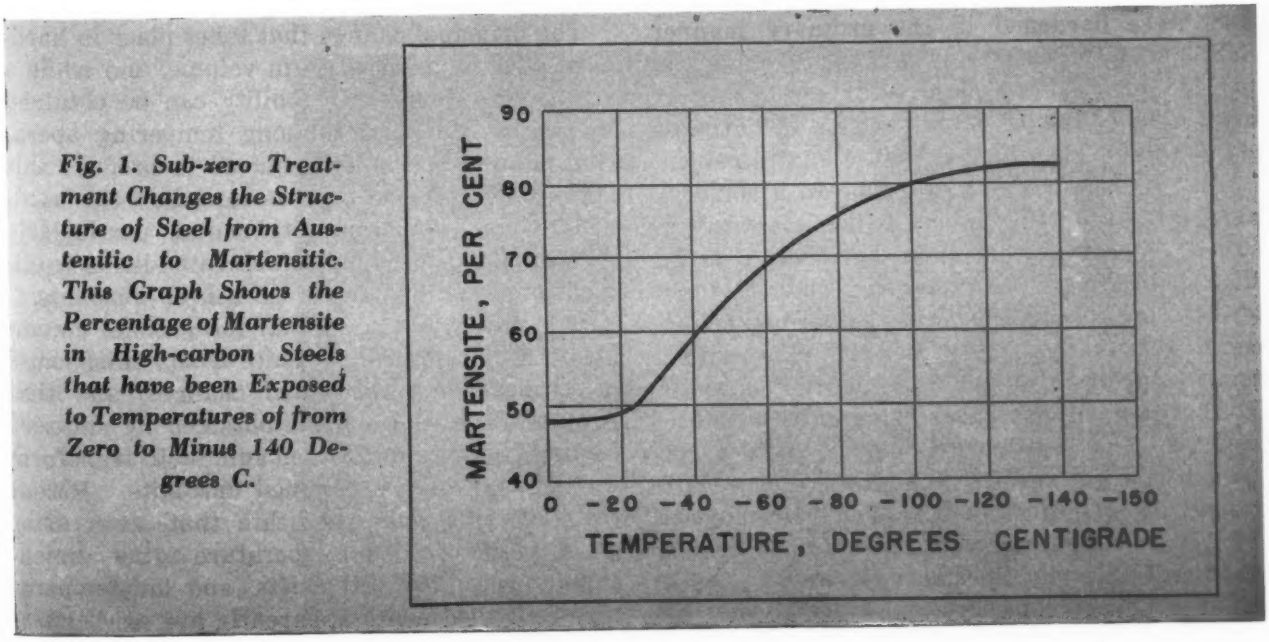


Fig. 1. Sub-zero Treatment Changes the Structure of Steel from Austenitic to Martensitic. This Graph Shows the Percentage of Martensite in High-carbon Steels that have been Exposed to Temperatures of from Zero to Minus 140 Degrees C.

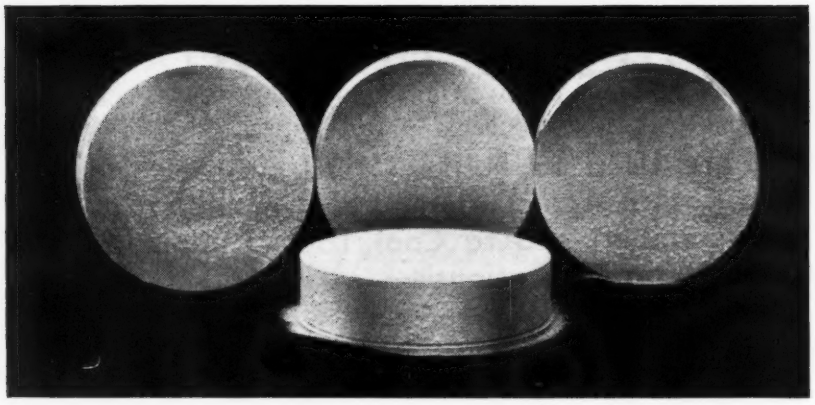


Fig. 2. Stainless-steel Molds for the Manufacture of Mirrors and Lenses are Cold-treated for Dimensional Stability

the various materials exhibited when cooled down to the temperature of solid carbonic acid (dry ice) or liquefied gases, such as liquid oxygen or liquid air.

Somewhat later an investigator, in a report on cooling powers, described some sub-zero experiments in which liquid air was used as a cooling medium. It was noted that cooling hardened high-carbon steel down to this very low temperature and allowing it to return to room temperature would cause a definite and regular specific volume increase.

It has only been in the last decade, however, that extensive use has been made of sub-zero cooling, except for stabilizing, shrink-fit assembling, and possibly some control of aluminum age-hardening. It was not until 1937 that sub-zero-hardened high-speed steel tools were found to perform better and to be capable of running at a higher speed than was possible with those that were hardened in the ordinary manner. Subsequent reports indicated that subjecting tool steels to low temperatures after heat-treatment would produce a combination of hardness, strength, and ductility otherwise unattainable.

This later work is responsible to a considerable extent for the unusually keen interest in sub-zero treatment of metals evidenced during the last few years. Another important factor in stimulating this interest was the development of commercial mechanical freezing units with a temperature range down to minus 120 degrees F. Recently the mechanical freezing units have been made even more effective, and can now be obtained in the minus 150 to minus 160 degrees F. range with 1000 to 2000 BTU per hour capacity. Still lower temperatures can be obtained in some of these units by special adjustment, but at greatly reduced capacity.

By using dry ice for the minus 110 degrees F. range, mechanical units for minus 150 degrees F. to minus 160 degrees F., and liquid nitrogen for minus 320 degrees F., the required temperatures can be obtained for various applications, such as stabilizing, shrinking, and hardening.

Sub-Zero Temperatures Used for Stabilization of Metals

With the increased demand for precision in manufacturing processes, dimensional stability of metals becomes a much more important factor. Now that the lower sub-zero temperatures are more easily produced, a high degree of stability can be obtained in a comparatively short time. In fact, what formerly took several years with out-of-door "seasoning" can now be accomplished in a few hours by low sub-zero temperature treatments.

The principal change that takes place in hardened steel is an increase in volume, and while a fairly high degree of stability can be obtained by resorting to several long tempering operations, the temperature required to produce this stability may be so high as to reduce the hardness. This would be detrimental, particularly when applied to gages, which in addition to dimensional stability, must have high hardness.

It is now well known that the gradual decomposition of retained austenite is the chief cause of progressive dimensional changes, and that rapid stabilization can be obtained by sub-zero cooling, which, if low enough, will transform virtually all of the retained austenite. Recent tests on plug gages indicate that, even after many years of room-temperature aging, dimensional instability still exists, and low-temperature cold-treatments apparently are essential.

For example, some plug gages ranging in size from 1 5/16 to 1 15/16 inches in diameter had worn under-size on the front end, and in some cases had actually increased in size on the opposite end. A minus 160 degrees F. treatment from five to fifteen hours increased the size of several of the gages from 0.0005 to 0.0008 inch per inch of diameter, or more than enough to refinish to standard size again. There was also an increase in hardness of from two to three points on the Rockwell C scale. This is particularly noteworthy because these gages were made before World War I and had had approximately thirty years of room-temperature aging prior to this sub-zero treatment.

In order to obtain the absolute maximum in transforming retained austenite, it is necessary to cool carbon and low-alloy steel to minus 250 to 260 degrees F. However, for most types of gages, including precision gage-blocks, sub-zero temperatures of from minus 120 to minus 150 degrees F. are usually low enough to produce the required dimensional stability. Precision gage-blocks are now being stabilized to within 0.000002 inch by bringing the blocks from room temperature to minus 120 degrees F. five or six times prior to the final finishing operation. Each sub-zero treatment is followed by a low-temperature draw, which is low enough to insure a hardness of 65 Rockwell C or better.

As such a high degree of stability is not usually required on ordinary gages and machine parts, one or two cycles is probably enough in most cases. At present there is not enough data available to draw definite conclusions as to the actual effect of multiple cycles versus single sub-zero treatments. It is believed, however, that where extreme stability and accuracy are required, such as for precision gage-blocks, best results are obtained by the multiple-cycle sub-zero treatments.

A typical example of stabilizing to within a few millionths of an inch is the optical system for television receivers. Mirrors and corrector lenses for television are made from a clear plastic, and are usually produced in molds made from Type 420 stainless steel, as shown in Fig. 2.

These molds are hardened and tempered to about 52 Rockwell C, and stabilized by a series of sub-zero treatments at minus 150 degrees F. The semi-finished mold blanks are put in a freezing unit, Fig. 3, immediately after they reach room temperature, following the hardening and tempering operation, and are held at the sub-zero temperature for about ten hours. After they have returned to room temperature, they are tempered at about 350 degrees F. for four hours. This cycle is repeated twice, making a total of three freezing and tempering cycles.

Before being molded, these parts are lapped. The cast-iron laps used are heat-treated and stabilized by two cycles of minus 150 degrees F. They are held at the sub-zero temperature about ten hours for each cycle. Each lap then is finished flat to an accuracy of better than 5 micro-inches, as measured by an 11-inch optical flat.

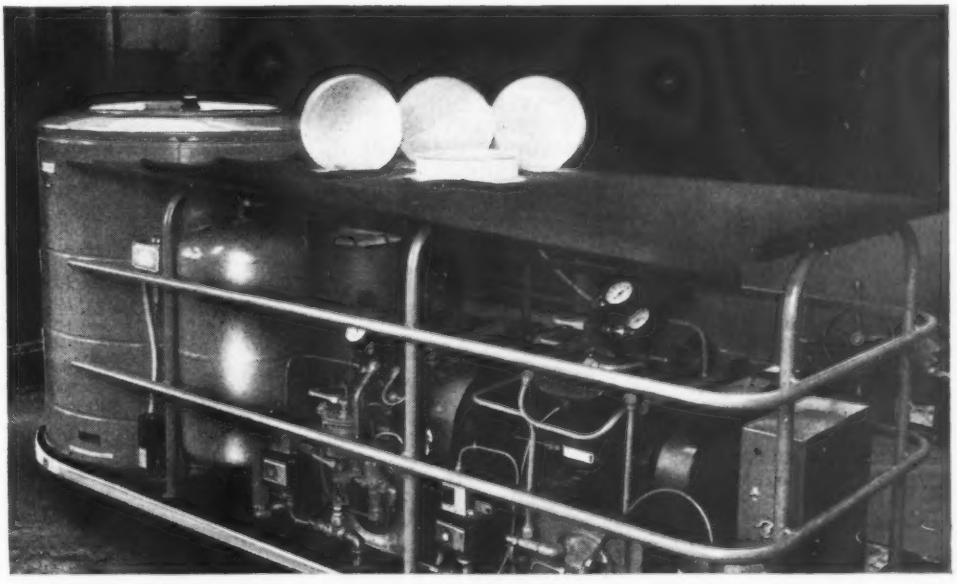


Fig. 3. A Sub-zero Freezing Unit for the Treatment of Mirror and Lens Molds is Capable of Producing Temperatures of Minus 150 Degrees F.

This stabilizing method appears to be very effective. Both the laps and the molds are checked for accuracy and flatness with an 11-inch optical flat having a guaranteed accuracy of better than 2 micro-inches. Each of the laps was flat to within approximately 5 micro-inches eight months after they were first stabilized and finished.

Before the freezing unit shown became available, several mold blanks for television lenses were stabilized by cooling to minus 60 degrees F. for twenty-four hours, followed by tempering at 350 degrees F. for three hours. After rough-grinding and lapping, they were packed in dry ice, and a few hours later transferred to a container of liquid nitrogen. This treatment apparently produced complete dimensional stability also, because even after a long period of use no change in size or distortion has been discovered.

Large machine parts, surface plates, lamination die-shoes, and various types of castings have been stabilized at the Bridgeport Works of the General Electric Co. in a cold room originally built for testing heated flying suits. This room, 12 by 15 feet in size, is usually operated at temperatures of minus 40 to 60 degrees F. The temperature can, however, be reduced to as low as minus 75 degrees F. provided the outside temperature is not excessively high.

Precision machine ways, about 5 feet long, made from heat-treated alloy steel have been stabilized in this room by two cycles of minus 60 degrees F., each followed by a 300 degrees F. tempering treatment. Some of these parts have been in service for a year or more, and no change in size or distortion has been discovered by ordinary checking methods, which, of course, do not include anything as precise as optical flats.

Shrink-Fit Assembling Processes

The sub-zero method of making shrink-fit assemblies is one of the most useful applications of the low-temperature treatment. Many types of assemblies can be made by this means that were impractical or impossible with the old process of using heat alone. With the use of sub-zero temperature to reduce the diameter of the plug, stud, or bushing, heating of the ring, or outer member, is either unnecessary or can be restricted to, say, 200 to 400 degrees F. Certain steels and most of the aluminum alloys may be damaged if heated to the high temperature required for a shrink-fit assembly, but by using the cold-treatment on the internal part, heating of the external part can be restricted to a point where it will do no harm.

Shrinkage of a 2-Inch Diameter Steel Cylinder When Cooled to Sub-Zero Temperatures

Material	Rockwell Hardness	Shrinkage on Diameter (Inches)		
		−110 Deg. F.	−160 Deg. F.	−320 Deg. F.
High-Speed Steel (18%W–4%Cr–1%V)	C63	0.0022	0.0028	0.0039
High-Speed Steel (6%W–5%Mo–4%Cr–2%V)	C64	0.0021	0.0026	0.0040
High-Speed Steel (18%W–4%Cr–2%V–9%Co)	C65	0.0020	0.0026	0.0035
High-Speed Steel (5%W–4%Mo–4%Cr–4%V)	C64	0.0025	0.0032	0.0045
High-Speed Steel (4%W–5%Mo–4%Cr–1%V–12%Co)	C67	0.0020	0.0023	0.0031
Tool Steel (1.10%C)	C66	0.0024	0.0028	0.0039
Tool Steel (0.90%C–1.20%Mn–0.50%Cr–0.50%W)	C63	0.0023	0.0027	0.0040
Tool Steel (0.50%C–0.90%Cr–1.25%W)	C66	0.0024	0.0029	0.0036
Tool Steel (2.25%C–12%Cr–1%Mo)	C64	0.0025	0.0027	0.0040
Chromium-Vanadium Steel (S A E 6150)	C58	0.0026	0.0029	0.0044
Machine Steel (S A E 1020)	B86	0.0023	0.0028	0.0044
Cast Iron	B85	0.0022	0.0025	0.0037
Stainless Steel (18%Cr–8%Ni)	B82	0.0033	0.0041	0.0057
Brass (66%Cu–34%Zn)	B60	0.0041	0.0046	0.0072
Copper	F82	0.0036	0.0038	0.0062
Bronze (S A E 660)	F78	0.0038	0.0043	0.0065
Aluminum (2–S)	H64	0.0043	0.0056	0.0062
Aluminum (24S–T)	E98	0.0031	0.0055	0.0080
Magnesium (Type M)	H79	0.0051	0.0063	0.0094
Invar "36"	B78	0.0003	0.0005	0.0011
Cast Alloy (20%Co–8%W–7%Mo–5%Cr–2%V–0.7%C–0.7%B–Balance Fe)	C69	0.0018	0.0022	0.0029
Cast Alloy (44%Co–17%W–33%Cr–2.25%C–2%Fe)	C58	0.0020	0.0025	0.0035
Carboloy (Grade 44A)	A91	0.0003	0.0006	0.0015

In recent years, several automobile manufacturers have used the sub-zero method for assembling cast-alloy valve-seat rings in cylinder blocks. Before being subjected to the freeze-shrink process each ring was chamfered slightly around the upper outside edge and the corner of the recess was rolled or peened over to hold the ring in place. This caused distortion both from pressing the rings in and from the peening or rolling over of the recess edge. The freeze-shrink method was tried out, and proved so successful that it was adopted as standard practice. Sub-zero shrinkage of the rings and then lightly pressing them in place was found to hold them so firmly that no peening or rolling of the recess edge was required.

Another successful application of the freeze-shrink process is in the construction of coining dies and cold-forging dies. These dies, often made from one of the tungsten "shock" steels, usually have a heat-treated alloy-steel block shrunk on as a safety factor to prevent splitting. In using the sub-zero shrink method for this operation, there is no danger of reducing the hardness of the die by the tempering action of the external part, because in most cases, heating of this part can be restricted to a point where it will be entirely safe.

Casehardened ring gears are difficult to assemble by the conventional shrink-fit method. If the ring gear is heated to a high enough temperature to produce sufficient expansion, the hardness will be reduced by the tempering action. This applies particularly to small diameters, where a much higher heat is required to produce the necessary expansion. By using the sub-zero method, little or no heating of the gear is necessary, unless the diameter is very small. When the diameter of the internal part is less than 3 inches, it is advisable to heat the ring or outer member to about 300 to 400 degrees F., depending on the type of shrink fit required.

The accompanying table is intended to aid in establishing freeze-shrink fit allowances. Actual test pieces, 2 inches in diameter and 1 inch long, with a 3/8-inch center hole, were cooled from 70 degrees F. to minus 110 degrees F., minus 160 degrees F., and minus 320 degrees F., respectively. Actual contraction or shrinkage of the 2-inch diameter was measured when the test pieces had cooled down to the sub-zero temperatures as shown in the tabulation.

Control of Age-Hardening by Sub-Zero Temperatures

The most important application of controlled age-hardening is the use of sub-zero temperatures to delay the hardening of aluminum rivets. Heat-treated rivets of either 17S or 24S aluminum alloys begin to age-harden a very short time after quenching. In order to keep the rivets in a soft condition for driving or upsetting, it is necessary to suspend the age-hardening action by suitable cold storage. The 17S aluminum alloy will begin to harden in approximately one hour after quenching, but the 24S aluminum alloy starts to harden in about fifteen minutes. If the rivets are stored at 32 degrees F. immediately after quenching, age-hardening is suspended for about two days, but by using sub-zero temperatures of minus 40 to minus 50 degrees F., the age-hardening action can be delayed for several weeks.

In a similar way, punched and formed parts made from 17S-O or 24S-O aluminum alloys can be heat-treated after the blanking operation and stored at zero or sub-zero temperatures until ready for the forming operation. This is particularly advantageous for long and slender parts that may become distorted if heat-treated after forming.

Sub-Zero Air Coolant for Metal-Cutting Tools

The life of small Carboloy milling cutters has been increased more than 400 per cent by applying a stream of sub-zero-cooled compressed air on the cutter edge during milling. In addition to lengthening the cutter life, this practice also makes it possible to obtain a better and smoother finish. The cooling apparatus used for this purpose is shown in Fig. 4.

This method of cooling was first tried in the Bridgeport Works on a gun-turret cam-milling operation. The cams were made from Type 410 stainless steel, heat-treated to 30 to 35 Rockwell C. Before using sub-zero-air cutter cooling, it was usual to regrind the cutters after millng only one cam. By using sub-zero air, four or five and sometimes six cams could be milled before the cutters had to be reground.

Also, with low-temperature air cooling, it is possible to use cutters made from a type of tool steel that has low "red hardness," such as tung-

sten finishing steel. With such cooling, tools made from this type of keen-edge high-carbon steel can be run at a much higher speed without danger of drawing the temper or reducing the hardness.

Application of Sub-Zero Temperatures to Hardening of Steel

Perhaps the most interesting and also the most controversial application of the sub-zero treatment is its use for further hardening of tool steels. Many papers and booklets have been written describing how hardened high-speed steels have been improved by the sub-zero treatment to such an extent that tool life has been increased from 20 to well over 500 per cent.

It has been difficult to conduct reliable factory tests on sub-zero-treated high-speed steel tools, but from data obtained thus far, it appears that analysis, design, and method of heat-treatment all have considerable influence on the effect the sub-zero treatment will have on a tool.

In regard to the analysis, it appears that the high-carbon high-cobalt types are more benefited by the sub-zero treatments than the 18-4-1 (18 per cent tungsten, 4 per cent chromium, 1 per cent vanadium) or the 6-6-4-1 (6 per cent tungsten, 6 per cent molybdenum, 4 per cent chromium, 1 per cent vanadium) types. It also has been found that certain types or designs of tools have considerable influence on what improvements may be obtained from a sub-zero treatment. For example, radial-relieved form cutters, such as shown in Fig. 5, gear-cutters, worm-gear hobs, and cut thread taps that are ground on the tooth face only will usually show more improvement than tools that are ground all over, particularly if they are hardened in a high carbon-monoxide atmosphere such as Drycolene or by the carbon block method.

Tools of the types mentioned hardened in a somewhat carburizing atmosphere are not fully tempered by the conventional method of using one or two draws at 1050 degrees F. Especially does this apply to the high-carbon high-cobalt

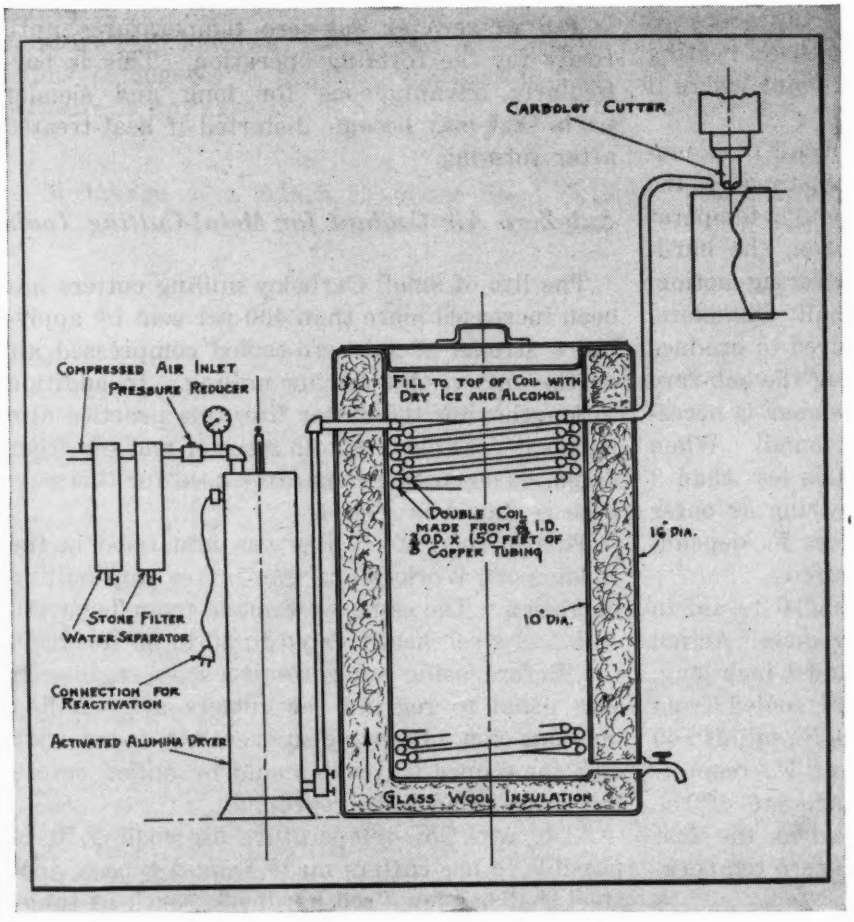


Fig. 4. Sub-zero Air-coolant Apparatus Used in Cooling Metal-cutting Tools. A Stream of Sub-zero-cooled Air Applied to the Edge of a Carboloy Milling Cutter during Operation Increased its Life More than 400 Per Cent

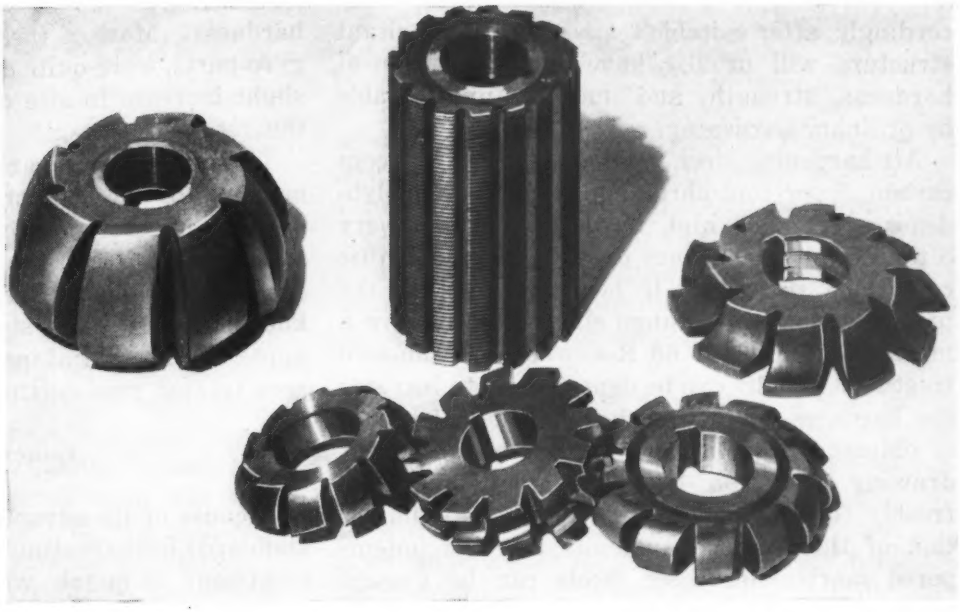


Fig. 5. Radial-relieved Form Cutters Show More Improvement from Sub-zero Treatment than Tools that are Ground All Over

and the high-carbon high-vanadium tool steels. These steels are improved by a sub-zero treatment applied after the first tempering operation. Also, tools of this type are better prepared for cyanide nitriding if given a sub-zero treatment of minus 110 degrees F., minus 120 degrees F., or better still, minus 150 degrees F. Without cold-treatment there is enough retained austenite to cause embrittlement of the carburized cutting edge.

Lamination dies, or any other types of dies made from high-speed steel, are hardened at a much lower temperature than ordinary high-speed steel tools. This is accomplished by packing in a carbonaceous material, such as granulated hard-wood charcoal, and heating preferably in a fairly high carbon-monoxide atmosphere. The hardening temperature can be as low as 1850 degrees F. for the 6-6-4-1 or M-2 types and 1950 degrees F. for the 18-4-1 type. After an oil quench, the dies are given the regular high-speed steel tempering of about 1050 degrees F. for one or two hours. While this tempering will not completely transform the high-carbon austenite of the cutting surface, virtually complete transformation can be obtained by a minus 150 degrees F. cold-treatment sandwiched in between two tempering operations. The result is a much better cutting edge, which can be still further improved by cyanide nitriding.

High-speed tools that have been damaged by abusive grinding can often be improved by a sub-zero treatment. Some cases have been found where a thin layer has actually been rehardened by severe grinding. In such cases, it is quite possible that there will be a definite improvement in tool life after a sub-zero treatment, which will recondition this freshly formed martensite and make a better cutting edge. This is perhaps one of the reasons why some stock tools, or what are often called "shelf tools," are improved by sub-zero treatments. Another reason why "shelf tools" show improvement may be due to sub-zero transformation of retained austenite.

Tungsten "shock" steel, of the 0.50 per cent carbon, 1 or 2 per cent tungsten, and 1 per cent chromium variety, is used extensively for cold-forging dies, mold hobs, and embossing dies. This type of steel usually has to be carburized to obtain the required case hardness of 60 to 63 Rockwell C, and core hardness of 54-57 C. This high case hardness, backed up by a strong core that is hard enough so that it will not sink under pressure, makes this steel valuable for many purposes. While it has been one of the best available for many difficult jobs, it can be further improved by suitable sub-zero treatments. Even after tempering to the required hardness, a sub-zero treatment of minus 150 degrees F. will further increase its hardness several points on the Rockwell C scale.

Numerous factory and laboratory tests indicate that if a sub-zero treatment of minus 150 degrees F. is applied after a tempering of about 350 degrees F., there will be almost complete transformation of the retained austenite. Ac-

cordingly, after suitable tempering, the resultant structure will usually have a combination of hardness, strength, and ductility unattainable by ordinary hardening.

Air-hardening steel, particularly the 1 per cent carbon, 5 per cent chromium, 1 per cent molybdenum type, has high hardenability, but very often exhibits a tendency to stay in the austenitic condition. However, if heat-treatment in the proper temperature range should fail to give a hardness of at least 60 Rockwell C, a sub-zero treatment usually can be depended on to increase the hardness. When such a hardness increase is obtained, it is important that a subsequent drawing operation be added to temper the freshly formed martensite. After the elimination of the retained austenite and the untempered martensite, these steels can be ground much more easily, and there is little or no tendency to develop any grinding cracks. Factory tests indicate greater strength and longer tool life in the high hardness ranges.

For example, cold-forging dies made from this type of steel and used for producing screwdriver blades were hardened to about 60 to 61 Rockwell C. This was as high a hardness as it was possible to obtain on these large dies, which measured about 3 by 3 by 7 inches. Owing to the tendency of some of these dies to sink and thus fail in service, it was decided to first subject the steel to a cold-treatment of minus 155 degrees F. for ten hours and then to temper it at 300 degrees F. This resulted in an increased hardness of five to six points on the Rockwell C scale, and the reported increase in tool life was more than 100 per cent.

Chromium ball-bearing steels, such as S A E 52100, also exhibit a definite tendency to remain austenitic after ordinary hardening and tempering. This usually results in low hardness and dimensional instability, as mentioned previously. Like the 5 per cent chromium air-hardening steel, S A E 52100 and similar types will respond well to sub-zero treatment. A cold-treatment of minus 150 degrees F. applied after the first tempering operation, results in a hardness increase of several points on the Rockwell C scale, and also in virtually complete dimensional stability.

During the war period, many hundred parts made from S A E 52100 that failed to meet exacting hardness specifications were sub-zero treated and usually brought up to the required hardness. Most of these parts, such as torpedo gyro parts, were quite small; therefore, the very slight increase in size due to transformation of the retained austenite was not objectionable.

To some extent, carbon steels appear to be benefited by low-temperature treatments. Cold-header punches and dies are now being studied to determine if substantial increases in tool life are due to sub-zero treatments or to some unknown factor. Also studies are being made of apparent substantial increases in tool life of sub-zero treated steel-cutting band-saw blades.

Conclusions

Because of its advantages as a supplement to standard heat-treating methods, the sub-zero treatment of metals will increase in industrial importance in the next few years. Its applications can be summarized as follows:

1. Size stabilization can be accomplished without loss of hardness if a sufficiently low sub-zero temperature is used.

2. When there is much retained austenite, transforming it to martensite will increase both the size and the hardness of the part; therefore, sub-zero processes can also be used to salvage tools, gages, or parts that are under size or low in hardness.

3. Sub-zero shrink-fit assembling methods are superior to the old "heat-expansion-shrink" process, and can be used in many cases where the old method was impractical.

4. Sub-zero control of aluminum age-hardening, while now used mostly for rivets, can also be employed to control age-hardening when parts are fabricated from heat-treatable aluminum alloy sheets.

5. The successful use of refrigerated compressed air as a coolant for small milling cutters indicates that commercial mechanical freezing units should be developed for this purpose.

6. Certain types of high-speed steel tools are benefited by a suitable sub-zero treatment, particularly radial-relieved form cutters hardened in a high CO atmosphere.

7. All hardened steels are improved by the proper sub-zero treatment to the extent that there will be less tendency to develop any grinding cracks; they can be ground much more easily after the elimination of the retained austenite and the untempered martensite.

Now is the Time to Train the Skilled Workmen of the Future

EXECUTIVES responsible for production in the metal-working industries have complained for years about the dearth of skilled toolmakers, diemakers, and other mechanics. Gone are the good old days, they say, when men could be hired who were capable of operating any machine tool in the shop and of adjusting or repairing it. It is significant that, according to estimates, Germany had 200,000 tool and die makers when that country entered the recent war, whereas there were only 60,000 in the United States, with its much greater population. Industry was at least partially to blame for that state of affairs.

Right now seems to be an ideal time to take steps to insure an adequate supply of skilled workmen during the coming years. Under the G.I. Bill of Rights, returning servicemen can become apprentices at the present time with the assurance of a satisfactory livelihood during the period in which they are learning their trade. An ex-soldier without dependents may receive a subsistence allowance of $65 a month, and one with dependents may receive up to $90 a month. This money, added to the wages paid apprentices today, makes a substantial income. In fact, apprentices can receive as much as $200 a month all the time they are learning their trade. They need not struggle along on the pittance received by our grandfathers while they were serving their time. When has there been a better time to learn a trade?

And the advantages are not confined to the apprentices; management, too, will derive benefits. With the inducements of a good monetary return, the highest types of young men will be attracted to apprenticeship courses. Besides, the apprentices are not likely to become disgruntled or discouraged as readily as in the days when they had to support themselves with a meager wage. The turnover of apprentices should be low for the same reason. This is important because, in the past, the turnover made apprenticeship training a costly operation for employers.

Two essential steps are involved in setting up an apprenticeship course for veterans. First, the course must be certified by the appropriate state agency as being duly qualified; and second, the veteran must have a Certificate of Eligibility and Entitlement from the Veterans' Administration. This certificate indicates the length of time that the applicant is entitled to the subsistence allowance—the maximum period is four years.

Apprenticeship agreements, in general, call for 4000 hours of reasonably continuous employment for each person, and for his participation in an approved schedule of work experience which must be supplemented by 144 hours annually of related classroom instruction. The Apprentice Training Service of the U. S. Department of Labor maintains a staff of representatives in the field to assist management and labor in setting up apprenticeship training programs, and the International Association of Machinists is cooperating wholeheartedly in the program.

Recent figures show 7780 registered programs in training automobile, aircraft, and other mechanics; 4177 programs in the machine tool and diemaking industries; and 686 programs in other metal-working industries. Certain sections of the country, however, are notably behind the others in the number of apprentices and programs. To insure future skilled help in all areas, industry should get busy there, too, and right now!

Charles O. Herb

Erik Oberg Reports on Industrial

Impressions Gained in a Tour of Germany, Austria, Italy, and France Recently Made by Erik Oberg, Consulting Editor of MACHINERY, as a Member of a Group of Ten Journalists Traveling under the Auspices of Robert P. Patterson, Secretary of War

TO survey industrial conditions in Central Europe and Italy in the space of a brief article is no easy task. Hence, only the most important industries in the machinery field will be referred to. It was difficult to obtain complete data, especially in Germany and Austria, since practically no information is available as to the industrial conditions in the Soviet zones. However, all official sources of information in the American and British zones were placed at the disposal of the visiting journalists, and from such information, as well as from data obtained from authoritative private business sources, the following review has been prepared.

In order to make clear the present conditions and the prospects of the German machinery industries, it will be necessary to review briefly the conditions imposed upon Germany with regard to present and future production in this industrial field. In accordance with the Berlin Protocol, the Allied Control Council, in order to eliminate Germany's war potential, has first of all prohibited the production of arms, ammunition, and implements of war, as well as all types of aircraft and seagoing ships. The production of ball and tapered roller bearings, certain types of heavy machine tools, and heavy tractors is also forbidden. Partial facilities for manufacturing ball and tapered roller bearings will be retained to meet domestic requirements until these bearings can be imported and paid for by German exports.

The capacity of the steel industry in Germany is to be restricted to that sufficient for the production of 7,000,000 tons of ingots. This figure is subject to review for further reduction. The production of steel in Germany is not to exceed 5,800,000 tons in any year without the approval of the Allied Control Council; but this figure is also subject to an annual review by the Council. Germany's pre-war steel production was 26,000,000 tons, so that the present allowed production is slightly over 20 per cent of the pre-war output. It is further provided that the steel plants to be left in Germany, so far as practicable, shall be the older ones. The machinery and equipment for production not allowed in Germany, in all fields, will be removed as reparations to the Allied nations.

Restrictions on German Machine Tool Industry

Referring specifically to the machine-building industry, about 85 per cent of the 1938 machine tool building capacity will be dismantled and available for reparations payments. The Soviets have already removed 85 per cent of the machine tools in their zone. It is said that much of this machinery was damaged before it arrived at its destination, and that many machines removed

Results of One of the Eleven Air Attacks on the Kugelfischer Ball Bearing Plant in Schweinfurt, Germany, the Largest Single Factory in the German Ball Bearing Industry. About 55 Per Cent of the Floor Space of the Plant was Demolished in These Raids

as reparations have been rusting on railroad sidings because of inadequate protection. In the future, the machine tool industry will be permitted to produce 11.4 per cent of the 1938 capacity, with additional restrictions on types and sizes of machine tools. This figure may have to be revised upward, because it is doubtful if so small a production will be adequate to make Germany self-supporting.

Production Restrictions in Other Industrial Fields

In the heavy engineering industries, 31 per cent of the 1938 capacity will be retained. These are the industries that produce heavy mining machinery, material-handling equipment, power-plant equipment, metallurgical equipment, and the like. In other mechanical engineering industries, 50 per cent of the 1938 capacity will be allowed. This group includes construction equipment, textile machinery, consumer goods equipment, food-processing equipment, and woodworking machines.

In the electrical industry, capacity to produce heavy electrical equipment will be reduced to 30 per cent of the 1938 production. This includes generators and converters of 6000 K.W. and over, and large transformers of 1500 K.V.A. and over. In the electrical industry other than that producing heavy equipment, 50 per cent of the 1938 production capacity may be retained.

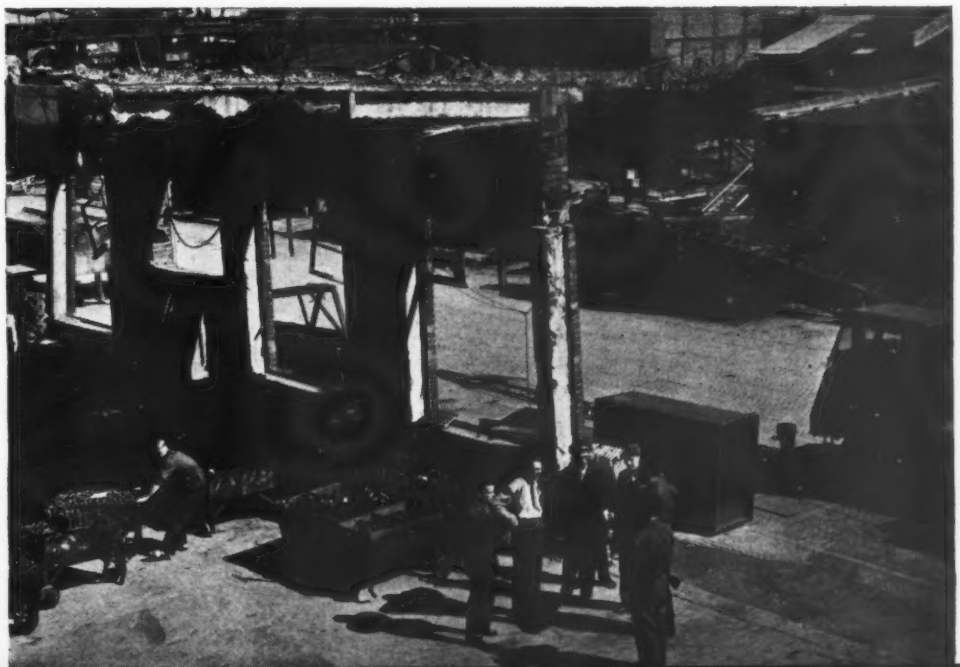
In the railroad field, the locomotive-building capacity will be used exclusively for the repair of existing engines, in order to build up a supply of 15,000 locomotives by 1949. A decision will be made later as to the building of new locomotives after 1949. Sufficient capacity will also be retained to produce annually 30,000 freight cars, 1350 passenger cars, and 400 baggage cars.

The agricultural machinery field will be permitted to produce 10,000 light agricultural tractors. A capacity for the production of other agricultural equipment at 80 per cent of the 1938 level is also to be retained. In estimating the machine building capacity to be retained, the production of normal quantities of repair parts for transportation and agricultural machinery is also taken into consideration.

Machinery and Plants Shipped for Reparations

Under this program, thousands of plants will be dismantled for reparations and removed to the Allied countries. A great many plants used only for the production of war materials are being destroyed. It is estimated that 230,000 tons of machinery will be dismantled and shipped this year.

Some responsible opinion was expressed to the effect that as far as the economy of the Allied nations is concerned, it would be better, in many instances, to leave the machine tool plants where they are, and let the Germans make new machine tools for reparations. Two objects would be gained in this way—first, the Germans would retain a means of making a living in a field in which they have the skill and training; and sec-



Although the Kugelfischer Ball Bearing Plant Lost over One-half of its Useful Manufacturing Floor Space, the Production of Ball Bearings Never Entirely Stopped. The Plant is now being Dismantled and the Equipment is being Shipped to Russia as Reparations

ond, the Allied nations would receive as reparations a better quality of machines than the old machines now being dismantled.

In the American zone, shortage of raw materials and all types of fuel have kept production at a low percentage of capacity. While many of the buildings were heavily damaged by bombing, the equipment in many cases is in surprisingly good condition; but due to other adverse conditions, the output of machine tools in 1946 in the combined American and British area was only about 1 1/2 per cent of the output in 1938.

The Ball Bearing Industry

The ball and roller bearing industry of Germany centered at Schweinfurt is said to have produced, during the war, from 80 to 90 per cent of all the German requirements for that period. The plants situated in that locality were, in fact, the most important ball bearing factories in Europe; the largest were Kugelfischer and the Vereinigte Kugellagerfabriken (VKF), the latter being owned by the original SKF ball bearing company in Sweden. As already stated, no ball bearings will be made in Germany after conditions in Europe have been so stabilized that Germany can buy bearings from the outside. At present, however, both the plants mentioned are operating to a limited extent.

The Kugelfischer plant was quite seriously damaged by air raids. Half of its equipment—7000 tons of machines—have been shipped for reparations to Russia. The other half is still operating on stock that was on hand, since the yards were filled with materials at the end of the war. Later, the remaining half of the plant will also be shipped for reparations, probably to a western power. Then, for some time to come, the VKF plant in Schweinfurt will maintain production for German needs until this plant, as well as the VKF plant in Stuttgart, which was also badly bombed but is partly in operation, is dismantled for reparations. At present, these plants operate at about 20 per cent of pre-war capacity. Last year their output was equal to 16 per cent of the pre-war production.

The military government of the U. S. zone is not in favor of dismantling any more plants in any industry branch until Germany can be considered as a unit. Only actual war production plants of no peacetime use are being dismantled and destroyed. The present four-zone management of the German industry is not very satisfactory due to the lack of complete cooperation between the zones, and the sooner the restrictions between the different zones are removed, the sooner can Germany be self-supporting and cease to remain a burden on the Allied nations. The American and the British zones are, however, now practically a unit from the industrial point of view.

Conditions Necessary to Make Germany Self-Supporting

Aside from the lack of coal and raw materials, the greatest obstacles to the speedy return of German industries to normal conditions, especially of the machinery industries, are stated to be as follows: The difficulty of rebuilding damaged plants because of lack of building materials; lack of labor—a large percentage of German men were killed or disabled in the war, and there are still some four to five million prisoners of war in the Allied countries; the removal of plants for reparations, in some cases, before their importance to a self-supporting German industry is fully understood; the uncertainty as to whether a plant will be licensed to operate or not. It is believed that the extreme restrictions on machine tool building also will hamper recovery, because Germany, itself, could absorb more machine tools than the allowed percentage.

In General, Factories Devoted to War Production and Not Suitable for Peacetime Output are Destroyed. Here is an Underground Plant at Muehldorf, Germany, which has been Blown up by the Use of 10,000 Pounds of TNT

Another great obstacle to the speedy recovery of Germany is the transportation situation. Both railroad and motor-vehicle transportation leave much to be desired. Practically all the railroad bridges over the major rivers and streams in Germany were destroyed either by the Allied bombing or by the retreating Germans. Only 10 per cent of these bridges have been replaced by permanent structures, while most of the other bridges are of a temporary character, necessitating slow train movements. The permanent way is also in very bad shape. Train speeds are greatly limited. The scarcity of steel is a problem both as regards rails and bridge construction. Locomotives and cars are in need of repairs.

The passenger movement is greater than ever before, due to the fact that the railroads must take up the slack caused by lack of automobiles and buses. Also, much equipment is required to move the so-called displaced persons and refugees, a subject that will be referred to later. All Germans must travel third class, in unheated cars. The first- and second-class cars are reserved for the occupying forces. The coal situation was so tense in January that the Bavarian railroads had only one and one-half days of coal supply ahead. Even the electrified railroads were short of power because the water level this winter was exceedingly low, thereby reducing the output of the hydro-electric plants.

Coal Production the Most Serious Bottleneck of All

The coal production in the Ruhr, which is the main supply center for the U. S. and British zones, was 450,000 tons a day previous to the war. Until a short time ago, it was only 175,000 tons a day. It has now been brought up to 230,000 tons, but this is only about one-half the normal production. The reason for this is lack of miners, many of whom were killed in the war or are prisoners of war. A large number of the present miners have had no training for this work, and their working efficiency has been low because of lack of food. In fact, 75 per cent of the pre-war force was able to produce only 40 per cent of the previous output in tonnage. This condition has been improved by giving the miners and their families food rations equal to those required by men doing similar work in other countries where food is not as scarce as in Germany. Both the coal and the steel industries are run by the American and British military governments.

As a result of the coal shortage, 75 per cent of the major industries in the U. S. and British zones were at a standstill for about three months. Coal for residence heating was generally allowed for only one room. In Berlin, the coal supply for residences was one-tenth of the former consumption, and in Hamburg, it was said that no coal for residence heating had been available since October.

Prospects in the German Automobile Industry

In 1938, the total production of passenger cars in Germany was 275,000. In addition, 1000 buses, 40,000 trucks, 26,000 tractors, and 190,000 motorcycles were built. The only automobiles now being produced are the so-called "Volkswagen," of which approximately 10,000 were built in 1946. In addition, some 175 buses and 8500 trucks were produced.

Under the limitations restricting the number of passenger cars and trucks manufactured in Germany to 40,000 per year in each group, five of the seven automotive plants in the U. S. zone will be dismantled for reparations. The maximum authorized production of cars will allow only one for 2000 inhabitants. In the United States, the 1938 production was one car for each 30 inhabitants.

The Problem of Displaced Persons

No review of the German industrial situation would be complete without a few words about one of the most unusual problems created by the war—the problem of displaced persons, expellees, and refugees. Displaced persons are those who were forcibly brought into Germany as slave labor during the war, many of whom do not wish to return to the countries from which they originally came. There are today about a million of these people in Germany, 500,000 of which are in the U. S. zone.

Then there are the expellees. These are Germans and people of German ancestry in the countries conquered by Germany, who, in accordance with the Potsdam Agreement, may be expelled and forced to return to Germany. These will run into 3,000,000 or 4,000,000, of which the U. S. zone must absorb 2,250,000. In addition, there are the refugees—people who have voluntarily left their native countries for Germany, and Germans who came to seek safety in some part of Germany other than their home section. These groups have increased the normal population of the various zones by at least 15 per cent. Since housing in Germany was reduced at least 25 per cent (some say 40 per cent) by destruction in the war, the addition of 15 or 20 per cent to the population presents a real problem. As a

A Plant near Munich, Germany, after having been Dismantled by the Soviets and the Equipment Removed to Russia

result, the remaining housing facilities are greatly overcrowded, the average being at the rate of fifteen people to a seven-room house.

Obviously, this has an industrial significance as well. A nation living under these conditions is hardly at its best as regards efficiency and working capacity. This, coupled with the limited food rations due to food shortage and the scarcity of clothing, shoes, etc., presents a problem that will take many years to solve.

Steps Essential to Rehabilitation

For Germany to become self-supporting, export trade is necessary. The export possibilities from the U. S. and British zones for 1947 amount to about $350,000,000. Every means is taken by our military government to facilitate such exports, so that Germany may be able to buy food to survive. To make Germany self-supporting again is the world's most important problem at the moment, because Germany in chaos means western Europe in chaos, and what that means is obvious to anyone who has followed recent developments in international relations.

It is necessary to give the Germans a chance to produce. This is not just for the benefit of the Germans; it is for the welfare of all western Europe, and, in the long run, for the rest of the world. Holland, Belgium, the Scandinavian countries, and the nations of southern and southeastern Europe depend on many German products for the operation of their own industries, their communications, and their agriculture. As yet, no satisfactory substitute source of supplies is available, and the sooner Germany can fill this position the better off the whole world will be.

Hence, as mentioned, our military government does everything possible to encourage German exports. The sooner Germany can buy, through her exports, food supplies from abroad, the sooner there will be no need for the occupying nations to feed the German population. For three to five years Germany will depend partly on the United States and England for her support. After that, she can be made self-supporting. Three years is the goal, but it is somewhat uncertain whether we can reach this goal.

Industrial Conditions in Austria

In many respects, Austria has advanced toward her position as an independent nation more rapidly than Germany. Unfortunately, however, Austria has not the fuel and other raw materials that Germany has, and furthermore, many of these resources are in the Soviet zone and not freely available to the rest of the country. It is difficult to obtain accurate information as to what happens in the Soviet zone; hence, whatever is said about Austria relates specifically to the U. S. zone. Less than one-half of the machinery industries are in this zone, however. A recent census showed that there are 56,000 machine tools, of which 15 per cent are now producing, but over 90 per cent are in fair condition and could be used in production if there were power and raw materials available—again coal is the chief bottleneck.

It has been estimated by the Economic Division of the United States Element of the Allied Commission for Austria that some 18,000 machine tools will be needed for import into Austria if that country is to resume its industrial activity. While Austria never had a large machine tool industry, what it has is in a rather difficult position. It is estimated that the production in 1946 of machine tools was about 25 per cent of

the pre-war output; automobiles, 20 per cent; iron and steel, 30 per cent; agricultural machinery, 25 per cent; and electrical equipment, 20 per cent.

Austria had an important ball bearing plant at Stiyer. This was badly damaged by bombing, but was quickly rehabilitated and started to operate in May, 1946. The automobile industry also is beginning to show some activity. Some of the automobile plants have suffered from the removal of their machinery by the Soviets. Since some of the plants of importance in the automotive field are in the Soviet zone, figures as to production are not available.

The railroads in Austria have recovered to a remarkable degree; all bridges have been restored. Locomotive and car repair shops have returned to full operation. The level of railroad operation in the U. S. zone in September last year was not only much higher than in the other three zones of Austria, but was also higher than in any comparable district of the occupied areas of Europe. The operations are 97 per cent of normal, as compared with 24 per cent in the Soviet zone and 50 per cent in the British and French zones. All main track is in operation, and the bombed yards and terminals have been rebuilt, so that operation is no longer hampered. Ninety-two per cent of the electrified facilities have been restored.

The restoration of the Austrian railroad system to its former importance will greatly help Austrian industrial economy.

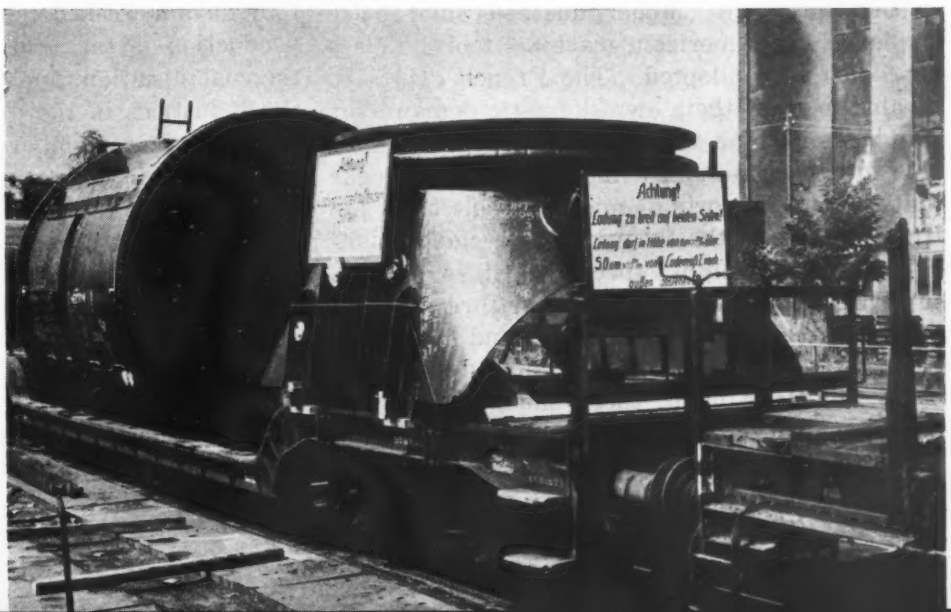
Industrial Conditions in Italy

Like all other European industries, those in Italy suffer from lack of coal and other fuels, as well as raw materials. Lack of coal is partly compensated for by water power resources. It is estimated that in 1938 the output of electric power from hydro-electric plants for all uses, including industry, was roughly equivalent to the power obtained from imported coal.

It has been difficult to obtain accurate figures on the actual war damage done to Italian industry. No industrial census has yet been completed, so that only estimates can be given. A generally accepted estimate is that the over-all damage to Italian industry caused by the war was about 25 per cent but, in addition, 90 per cent of the Merchant Marine and 75 per cent of the harbor installations were destroyed, and 75 per cent of the land transportation was interfered with, chiefly by the destruction of bridges. This has an important bearing on industrial activity.

Owing to the lack of fuel and the necessity to conserve electric power from the hydro-electric plants, industrial operations were reduced to four days a week during the winter. Even with these handicaps, however, Italy has made comparatively rapid progress toward normal industrial conditions. The production in all industrial fields in 1946 is estimated at 65 per cent of the 1938 output. The production in 1946 was double that of 1945.

To give a comprehensive idea of production is impossible, because accurate figures are obtainable only for the automotive industry and for railroad rolling stock production. There are, however, reviving activities in shipbuilding, Diesel engines, sewing machines, typewriters, and even machine tools. The machine tool industry, of course, was never a large one in Italy. It is estimated that by September, 1946, automobile production had reached 40 per cent of the pre-war level, and truck and bus production was ahead of the pre-war output. The Fiat company, in fact, is said to have reached a level of 75 per cent of the 1938 production in October, 1946. Iron and steel production had reached 70 per cent of its 1938 level.



Railroad Cars Loaded with Equipment Removed to Russia from a Power Plant Allocated to the Soviet Union in Payment of Reparations

The railroads still suffer from destruction due to the war. Many temporary bridges have been built. As an example of the destruction of modern warfare, it may be mentioned that in Italy alone, 12,968 railroad and road bridges were damaged in the war. To date, only 1700 have been rebuilt and 2950 have been repaired.

Industrially, France is Recovering Rapidly

Of all the continental countries, France has doubtless most nearly returned to normal conditions. Except for the scarcity of coal during the winter months, the French industries have practically recovered their pre-war activity. This applies especially to the machinery industries, and to the machine tool industry in particular.

During the war, the machine tool industry in France developed greatly. It is stated on good authority that today the machine tool output is three times the pre-war production. What is the reason for this activity? Unfortunately, the reason is not a healthy one. The instability of the franc makes it seem advisable for everybody to exchange francs for property of some kind. Owners of machine shops who have available capital deem it better to have this represented by machines and equipment than by francs in the bank or by investments that have merely a money return. Some of the machine tool building plants have business ahead for two years, but it is understood that if the boom does not last that long, many of these orders will be canceled. Well informed persons say that the boom may last two or three years; others say two years at the maximum unless something unexpected takes place to stop inflation and stabilize the franc.

Considerable improvements were made in the design of French machine tools during the war, and since the war great effort has been made to bring all designs of standard machines to a point where they may compare with American and British equipment. Modern methods such as are employed by American machine tool builders have also been adopted. The French expect to be able to meet their own domestic demand for standard machine tools and, in addition, to be able to export standard lines. It would appear that the only imports of machine tools from the United States in the future in appreciable quantities will be in highly specialized lines, such as superfinishing machines, lapping, thread-grinding, and gear-cutting machines, and centerless grinders, especially centerless thread grinders.

On the other hand, there should be a good potential market for American equipment in pressure die-casting machines, induction heating and hardening equipment, and in injection and pressure molding machines. American machines are now used in these fields. The interest in induction heating and hardening equipment is especially keen. Only one firm in Holland is now furnishing such equipment on the Continent.

French industry, in general, is not in a bad state, especially when one considers what a long road France had to travel. The railroads and the mines have been nationalized, as well as certain other industries, but the economic lines along which some of these industries are managed do not appear to be satisfactory for the French economy.

The automotive industry is operating at about 25 per cent of the pre-war output, which is considered quite good under the circumstances. The Renault plant has been nationalized, and no figures of its output are published. The Citroen plant is said to produce 100 cars a day—far below the pre-war figure. Sixty per cent of the output is for export, especially to Argentina and Brazil.

The electric industry is active, but has not yet reached pre-war levels. Electric motors are built to a considerable extent for export. The prices are high because of the scarcity of materials.

The railroads in France have reached almost pre-war efficiency. This is the only country on the Continent of which this can be said. Nearly the same number of trains—both passenger and freight—are run as in normal times, except that during the winter months there was a curtailment in traffic due to the scarcity of coal, which has forced a change to oil-burning locomotives in many instances. The destroyed bridges have been rebuilt in most instances, and on the main lines, trains are operated at pre-war speeds.

Were coal available in sufficient quantities, it is likely that within the year industrial production would rise to from 20 to 30 per cent above the pre-war output. Now many plants work only four days a week because of lack of coal. Steel production is far below normal, due chiefly to the coal situation, and this, of course, affects all the industries in the mechanical field.

It must be remembered that the French people suffered during the war (and still suffer) much privation, and they have not regained their usual working strength and stamina. Further, the important cities in the north were destroyed during the invasion as utterly as any cities in Germany, and as these were among France's principal ports, foreign trade is greatly hampered. It is also hampered by lack of the shipping required to bring in raw materials and food in exchange for manufactured products.

Rotary Power Filing Technique

Types of Rotary Files and Burrs; Methods of Selecting Them; and Operating Speeds to be Employed on Various Metals

ROTARY files and burrs are used with power-operated tools, such as flexible- or stationary-shaft machines, drilling machines, lathes, and portable electric or pneumatic tools, for abrading or smoothing metals and other materials. Corners can be broken and chamfered, burrs and fins removed, holes and slots enlarged or elongated, and scale removed in die-sinking, metal patternmaking, mold finishing, toolmaking, and casting operations. A rotary cone-shaped burring tool mounted in the chuck of a drilling machine is shown in Fig. 1 being employed for removing burrs from holes that have been drilled in a steel plate.

The difference between rotary files and rotary burrs is that the former have the teeth cut by hand with hammer and chisel before hardening, whereas the latter, have the teeth or flutes ground from the solid blank after hardening. Both classes of tools are manufactured by the Nicholson File Co., Providence, R. I., in the various shapes or styles shown in Figs. 2 and 3. The burrs are made from high-speed steel or cemented carbide. All the tools are made in three cuts—coarse, medium, and fine—the type to be used depending upon the amount of stock to be removed and the finish desired. Medium-cut tools are most generally used; the coarse-cut tools are required only for rough, heavy work and the fine-cut tools for special needs. Standard shanks are 1/4 inch in diameter.

The choice between a rotary file and a ground burr depends on the type of job and the preference of the user. The rotary files, with their hand-cut interrupted teeth or flutes, are better suited for work on tough, dense metals, such as die steels, steel forgings, and electric and gas welds. Generally the ground-from-the-solid burrs are more efficient on non-ferrous metals.

In using rotary files or burrs,

Fig. 1. Removing Burrs from Drilled Holes in a Steel Plate with a Cone-shaped Ground-from-the-solid Burring Tool Mounted in the Chuck of a Drilling Machine

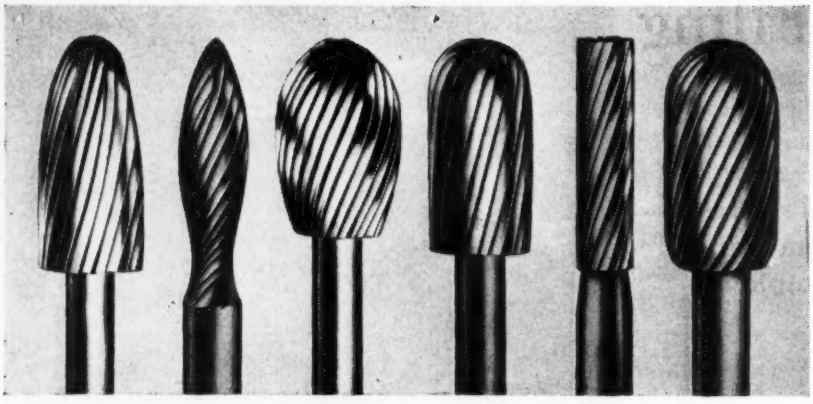


Fig. 2. Various Styles of Ground-from-the-solid Burrs that are Used with Power-operated Tools for Abrading or Smoothing Many Materials

the tool should be moved at an even rate and pressure to avoid producing an uneven surface. The shank of the tool should be gripped near the head or cut section for accurate control. Other than standard length shanks are made for special applications. For efficient operation, the tools should be kept sharp by regrinding.

The speed at which the tool should be operated varies with the skill and technique of the operator, the type of power used, the material being removed, the type of operation, and the size of the burr. Approximate speeds of medium-cut rotary files and burrs for general applications are given in the accompanying table. There are many instances, however, where speeds much higher than those given in the table have been used successfully. The best method is to determine from experience what speeds will give the most satisfactory results.

It is advisable to start using a burr at a fairly low speed and increase the speed as the burr becomes broken in until the best speed is found for the particular operation being performed. For finishing operations, higher than normal speeds with decreased pressure provide a better finish, although possibly with some sacrifice in rate of stock removal. Excessive speeds sometimes make it difficult to control the burr, and should be avoided. Speeds slower than normal usually result in a poorer finish and tend to decrease the rate of stock removal, although the latter is dependent on such factors as the pressure applied, characteristics of the material being operated on, and the manner in which the burr is used.

There is very little difference in the efficiency of rotary files or burrs when used in electric tools and when used in air tools, provided the speeds have been reasonably well selected. Flexible-shaft and other machines used as a source of power for these tools have a limited number of speeds which govern the revolutions per minute at which the tools can be operated.

The cemented-carbide burr is one of the most recent developments among these cutting tools.

Speeds of Rotary Files and Burrs

Tool Diam., Inches	Speed, Revolutions per Minute				
	High-Speed Steel Burr or File			Carbide Burr	
	Steel	Aluminum, Brass, and Soft Bronze	Magnesium	Steel, Iron, and Bronze	Stainless Steel
1/8	4000	14,500	16,000	48,000	82,000
1/4	3200	11,500	13,000	36,000	61,000
3/8	2600	9000	10,500	29,000	49,000
1/2	2100	7000	8500	24,000	41,000
5/8	1700	5500	7000	21,000	36,000
3/4	1350	4250	5250	20,000	34,000
7/8	1100	3250	4250	18,000	30,000
1	900	2500	3500	16,000	28,000
1 1/8	800	2000	3000	15,000	26,000
1 1/4	750	1750	2750	14,000	24,000

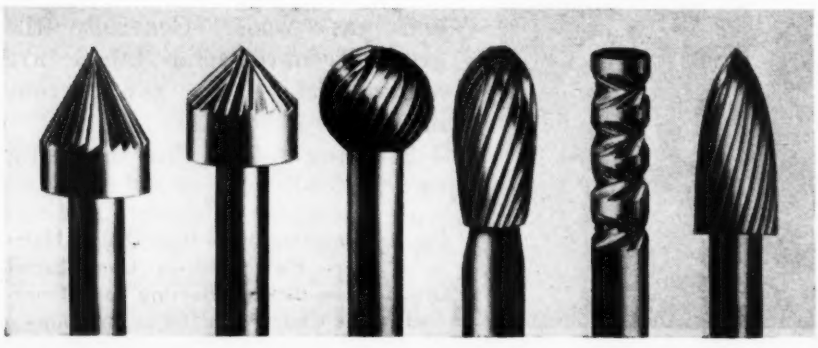


Fig. 3. Additional Styles of Ground Burrs. Rotary Files are also Made in the Types Shown in This Illustration and in Fig. 2

It has been demonstrated that a carbide burr will last up to 100 times as long as a high-speed steel burr of corresponding size and shape. Although costing approximately fifteen times more, these burrs have great possibilities for reducing costs, especially on long production runs.

The carbide burr may be used on hard or soft materials with equally good results. The principal difference in construction of the carbide burr is that its teeth or flutes are provided with a negative rather than a radial rake. Carbide burrs are relatively brittle, and must be treated more carefully than ordinary burrs. They should be kept cutting freely, in order to prevent too much pressure, which might result in crumbling of the cutting edges.

At the same speeds, both high-speed steel and carbide burrs remove approximately the same amount of metal. However, when carbide burrs are used at their most efficient speeds, the rate of stock removal may be as much as 400 per cent that of ordinary burrs. In certain cases, speeds much higher than those shown in the table can be used.

* * *

Directory of Research and Development Facilities in New York State

A directory of the research and development facilities available to industrial concerns at educational institutions in New York State has recently been published by the New York State Department of Commerce. This 80-page booklet lists sources of technical assistance, including laboratories, specialized personnel, and unusual equipment which may be utilized by industries in the state having special production or other technical problems to solve. A chart is included, which, in addition to giving the facilities for research and laboratory analysis at twenty-six universities and colleges, lists fifty-eight technical subjects on which specialized research is available, ranging from aeronautical engineering to X-ray work.

Copies of the directory are available without cost from the New York State Department of Commerce, 112 State St., Albany 7, N. Y.

* * *

Stainless steel is protected against corrosion and heat by a thin, tight armor of metallic oxide that is often so thin that it can't be seen. This armor is not plated on or applied as a coating. It is always present, and if scratched or broken, it repairs itself within 1/100,000 of a second.

Easily Remembered Temperature Conversion Formula

By C. E. HEINZ

A convenient and easily remembered formula for converting temperatures in degrees Centigrade to degrees Fahrenheit, or vice versa, is based on the fact that —40 degrees C. is equal to —40 degrees F. Since 9/5 degree F. is equal to one degree C., the number of degrees above —40 of any point on the Fahrenheit scale is equal to 9/5 times the number of degrees above —40 on the Centigrade scale. Conversely, the number of degrees above —40 on the Centigrade scale is 5/9 of the number of degrees above —40 on the Fahrenheit scale.

To convert from a Centigrade temperature to an equivalent Fahrenheit temperature, add 40 to the Centigrade temperature to get the number of degrees Centigrade above —40. Multiply by 9/5 to get the equivalent number of Fahrenheit degrees above —40, and then subtract 40 to get the number of degrees above or below zero degrees F. Briefly, the rule may be expressed as follows: To convert from Centigrade to Fahrenheit, add 40; multiply by 9/5; and subtract 40 from the resulting product.

Example 1—Find the Fahrenheit equivalent of 35 degrees C.

$$(35 + 40) \times \frac{9}{5} - 40 = 135 - 40 = 95 \text{ deg. F.}$$

Example 2—Find the Fahrenheit equivalent of —15 degrees C.

$$(-15 + 40) \times \frac{9}{5} - 40 = 45 - 40 = 5 \text{ deg. F.}$$

To convert from a Fahrenheit temperature to a Centigrade temperature, the procedure is exactly the same except that a multiplying factor of 5/9 is used. Thus, add 40 to the Fahrenheit temperature to get the number of degrees Fahrenheit above —40. Multiply by 5/9 to get the equivalent number of Centigrade degrees above —40, and then subtract 40 to get the number of degrees above or below 0 degree Centigrade. Briefly, the rule may be expressed as follows: To convert from Fahrenheit to Centigrade, add 40; multiply by 5/9; and subtract 40.

Example 3—Find the Centigrade equivalent of 41 degrees F.

$$(41 + 40) \times \frac{5}{9} - 40 = 45 - 40 = 5 \text{ deg. C.}$$

Example 4—Find the Centigrade equivalent of —13 degrees F.

$$(-13 + 40) \times \frac{5}{9} - 40 = 15 - 40$$
$$= -25 \text{ degrees C.}$$

Superfinishing Methods and Applications

By E. L. HEMINGWAY
Gisholt Machine Co., Madison, Wis.

Typical Applications of the Superfinishing Process on Bearings and Shop Tools, and for Inspection Work — Second of Two Articles

THE objective in "breaking in" two rubbing metallic surfaces is the wearing away of high spots so an increasingly perfect conformation of the two surfaces is secured. Unfortunately, most commercial finishes are so wavy and rough that the load pressure is concentrated on few but comparatively large areas. Severe scoring occurs too often at these points, and rapid wear, with progress toward increased instead of decreased roughness, is the result. All control over both conformation and clearance is lost. The principal advantage of the superfinishing process as described in the first installment of this article, published in March MACHINERY, is that it makes possible control over wear, producing so nearly a perfect surface that the remaining minute high spots are gradually worn away until the desired conformation of the two mating surfaces is realized.

Both common sense and experience indicate that there must be some limit to the amount of original inaccuracy that can be worn away while maintaining control over the rate of wear. An analogy, using a scraping process, will illustrate this. It is well known that a bearing surface so expertly machined that but a few thousandths of an inch need be removed by hand-scraping to get the required close and even distribution of high spots will usually result in successful operation. The spots will be smooth and almost flat, and the valleys between them will be exceedingly shallow. Only a little wear will occur until a smooth, 100 per cent bearing is secured. If, however, the machine work is so inaccurate that 0.020 or 0.030 inch must be scraped away, the spots will be rough and sharp, and deep valleys will exist. Scratching and scoring will be inevitable, and a 100 per cent bearing cannot be secured. This is true of grinding; the feed and chatter marks are too deep, too widely spaced, and of too uneven a height to permit the control of wear.

Superfinishing produces so close to a perfect surface that it is possible to wear away small inaccuracies in a controlled manner. In a number of cases, this process has made possible the

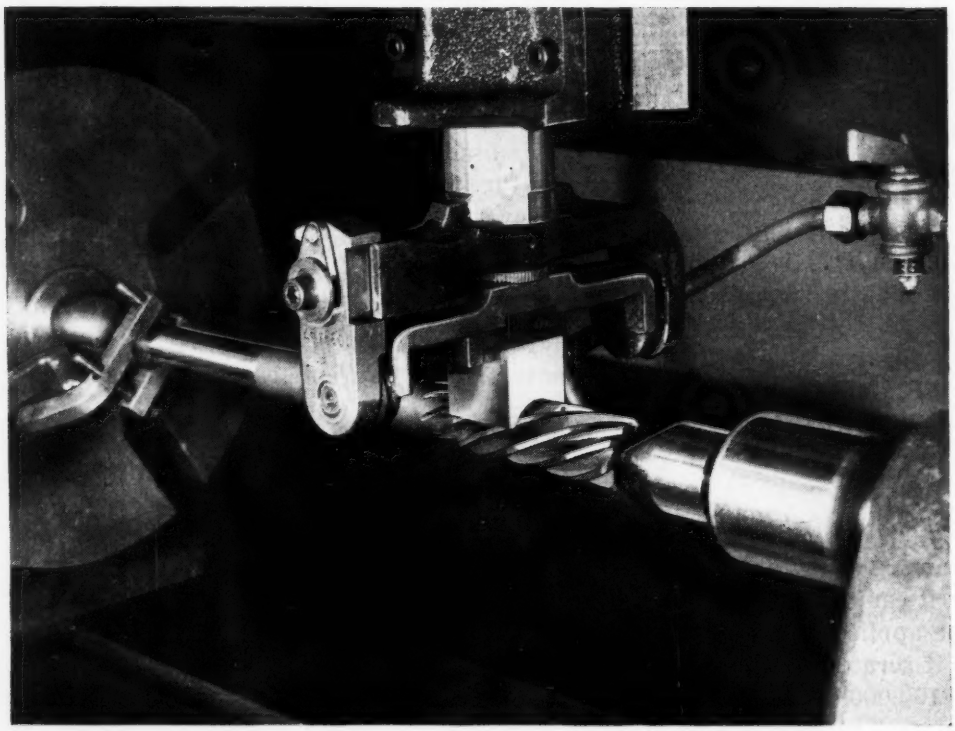


Fig. 1. The Superfinishing Process being Used to Remove Burned Cutting Edges and Grinding Marks from a Small Reamer. One Result of the Operation is an Increase in the Tool Life

operation of mechanisms that would not function without a high surface quality. Many times it has resulted in an actual reduction in over-all costs.

Superfinishing of Bearings

One of the most successful applications of the superfinishing process has been on bearings. In many machine bearings, close clearances are necessary to maintain precision in the spindle or shaft. Such precision can be attained only through the production of perfect surfaces. Parts turned on an engine lathe, for example, cannot be true and uniform if the clearance between the bearing and spindle is increased by wear and scoring. If the spindle wobbles and chatters in its bearings, such movement is reproduced on the surfaces of the parts. Any process by means of which a bearing surface becomes capable of improved operation over a long period of time obviously increases the value of a precision-built product. Superfinishing has proved successful in the manufacture of lathes, boring machines, grinders, automatic screw machines, and other machine tools.

Machine bearings often are ground with fine-grit, hard wheels in an effort to produce a mirror finish. Almost invariably, the heat generated is sufficient to melt a thin layer of metal, which then flows like thick paint over the area. This layer has a bright finish, but it is brittle and not securely attached to the underlying surface. At one time, roller-bearing races were ground in such a manner, and considerable trouble was experienced because of indentation of the surface by the rollers and flaking away of the smear metal layer.

Bearings subjected to variation in temperature during operation suffer in several different ways. The expansion due to heat causes the amount of clearance to vary, and it may become close enough for seizure to occur, or great enough for shaft flutter and reduction of the oil-film pressure. One way in which heat affects bearing operation is that it lowers the viscosity of the oil.

Certain bearing metals, such as babbitt, are employed because of their low welding affinity for steel. Most of them have low tensile strength and poor resistance to fatigue. Heat still further lowers these properties, and is often the cause of cracking and flaking of the surface because of the low resistance of the babbitt to alternating stresses set up by minute movements during operation.

It is obvious that the heat should be conducted away from the bearing just as rapidly as possible. This may be done either by a copious flow of oil or by good mechanical design. In many cases, the bearing liner is not an integral part of the housing; and unless the surfaces that form the union between the two are very closely fitted, transfer of heat is inefficient. Waviness and ridges, which may interfere with continuous metallic contact, must be removed from the sur-

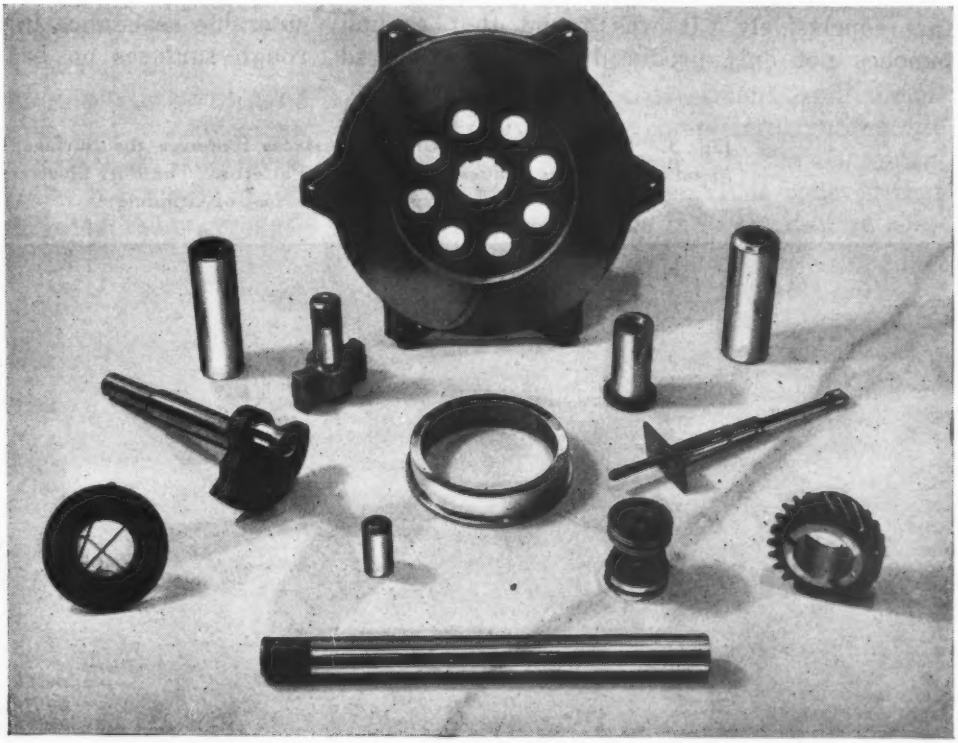


Fig. 2. A Group of Typical Superfinished Parts from the Automotive and Aviation Fields Includes an Automobile Clutch Plate, Sleeve Bearings, and Several Different Types of Shafts

face. The bore of main-bearing housings of automobile engines and the outside diameter of aviation engine liners are being superfinished to facilitate the transfer of heat and to eliminate the reproduction of any irregularities on the actual bearing faces.

Defects of fragmentation and shape are also detrimental to the operation of non-lubricated surfaces, such as pressure plates and brake-drums. Braking over too long a period of time can cause a temperature rise sufficient to burn the lining and score the drum unless the surfaces are smooth enongh so that intimate contact is provided for rapid transfer of heat from lining to drum to atmosphere. Most of the brake-drums used in American cars are superfinished.

Superfinishing Applied to Shop Tools

In order to obtain the best production results and maximum life, some small tools should be highly finished. Reamers are a good example. They have been impossible to grind to a sufficient smoothness without burning the cutting edges; therefore, they have not produced as many nor as smooth holes as they should. Removal of the annealed metal by superfinishing, as shown in Fig. 1, smooths the cutting edge and brings all the metal into the same true cylindrical plane, so that each edge does its share of the cutting.

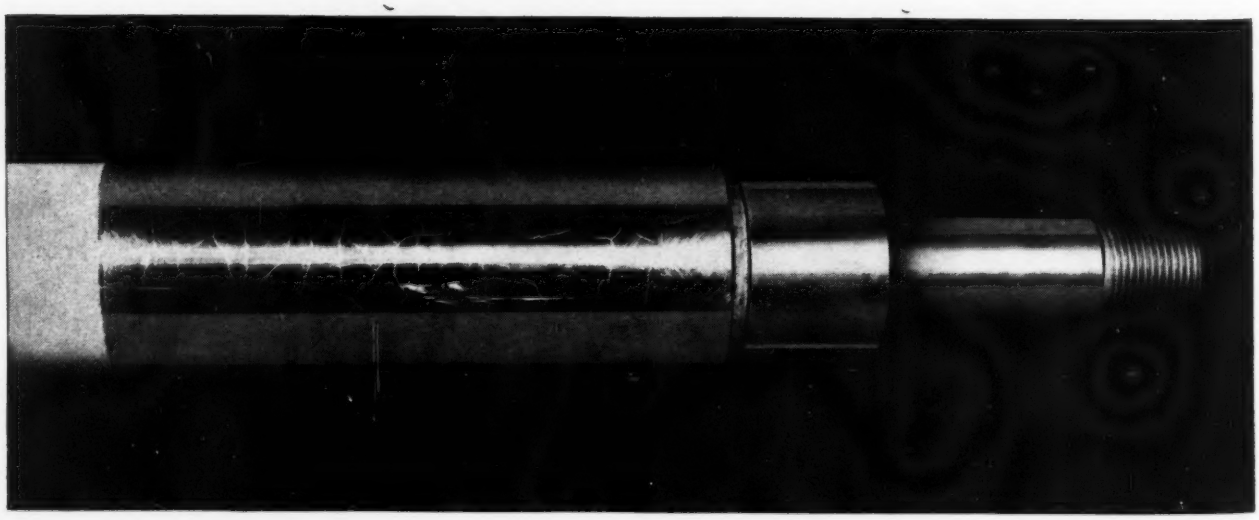
Piercing punches for blanking holes are also greatly improved by the removal of surface waviness. A report from a concern specializing in the manufacture of punches for piercing holes deeper than their diameters demonstrates this fact conclusively. It was found that ground punches not only produced holes with scored walls, but that the punch itself was scored. Experimental work with different analyses and hardnesses of steels did not materially change the situation. Chromium-plating of the ground punches was tried, but little improvement resulted. Finally, the punches were superfinished and then chromium-plated to a depth of 0.0001 inch. Galling, which had formerly occurred on the first four or five holes, did not appear until after 2500 holes had been pierced.

Other applications include the superfinishing of steam-valve disks and seats to reduce steam leakage as a result of wear; pump piston-rods to eliminate the rasp effect between the rod and the non-metallic packing; gun recoil pistons to improve performance; aircraft-engine parts to stop scoring; and Diesel-engine crankshafts and automobile tappet valves to improve smoothness where they contact mating parts. Fig. 2 shows some of these parts after finishing.

Inspection by the Superfinishing Process

One of the important applications of the superfinishing process is in the inspection of metal surfaces. Owing to the fact that the rigid, master-shaped surface of the superfinishing stone can contact only the highest spots at first, a short application abrades only those spots and exposes their pattern or distribution. Feed marks, chatter marks, or other forms of waviness are thus revealed. Repeated contacts of the stone will show the depth of these defects, with perhaps a gradual development of their entire shapes. This method of inspection has proved to be of considerable assistance in analyzing the effects of rough surfaces on bearing operation, since it

Fig. 3. Superfinishing of Ground Surfaces Removes the Surface Layer of Metal and Exposes Cracks and Grinding Patterns. The Part Illustrated Shows Cracks Caused by the Heat of Grinding



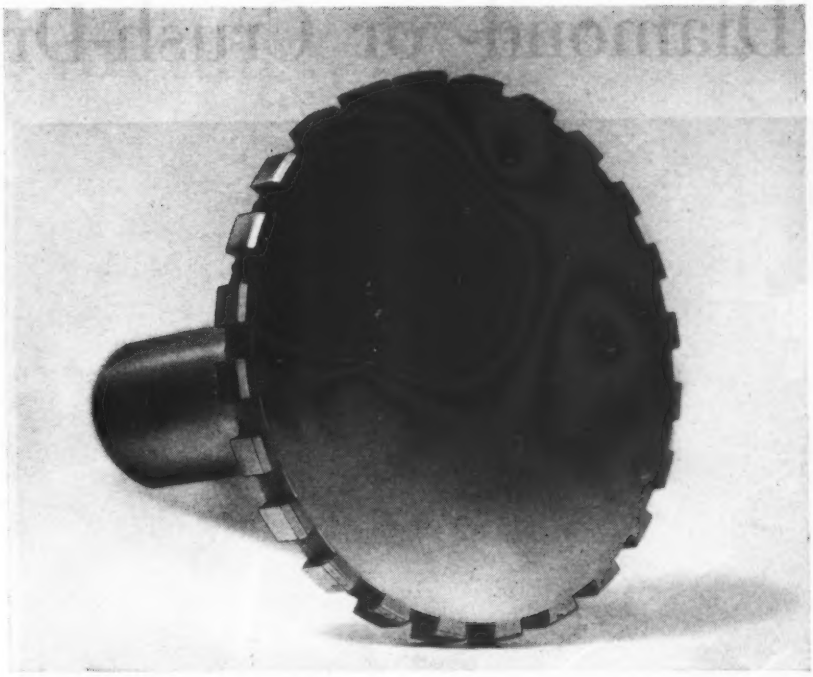


Fig. 4. An Aviation Tappet Head Finished to a Smoothness of 1 1/2 Micro-inches in Approximately One Minute

represents the general progress of actual wear. When the character, depth, and distribution of surface defects are plainly visible, it becomes much easier to interpret the basic causes of surface destruction.

Not only can irregularities of shape be quickly detected, but annealing is also immediately revealed. When a stone of the correct bond hardness is applied to a surface with an unusually deep "burned" layer, it will cut faster than expected and leave a dull gray finish. After that layer has been removed, and truly hard metal reached, the usual reflective surface will appear. Measurement on the comparator before and after superfinishing will show the depth of the layer.

Many times, parts have been received which visual inspection showed to be of normal appearance, but which, when superfinished, showed certain areas that contained numerous fine cracks that had been smeared over in the grinding operation (see Fig. 3). Rapid heating, followed by quenching, had set up stresses exceeding the tensile strength of the steel. This may have been due to the wrong choice of wheel or to some other grinding variable, or to the omission of the proper draw after hardening.

The fact that superfinishing reveals surface irregularities makes it obvious that measurement of superfinished surfaces can be taken with more consistent accuracy than the measurement of ground ones. The dimension measured on ground parts is that of the highest defects within the anvils of the measuring device. Unless extreme care is exercised to measure in exactly the same location, no two measurements are likely to be precisely the same, since another pair of defects will then determine the indicated dimension. Further, since the measurement of the dimension after the "breaking in" period is of still more interest, it is well to recognize that such high spots will be the first areas to wear away. In that case, it will be impossible to predict the exact running clearance.

Before the development of a satisfactory means of measuring surface roughness and of economically removing the defects of ground surfaces, most manufacturers gave consideration only to analysis of metals, heat-treatment, and dimensional accuracy. They completely ignored the most important feature of all—the characteristic of the wearing surface. It is believed that superfinishing has proved to be the desired solution to these surface production problems.

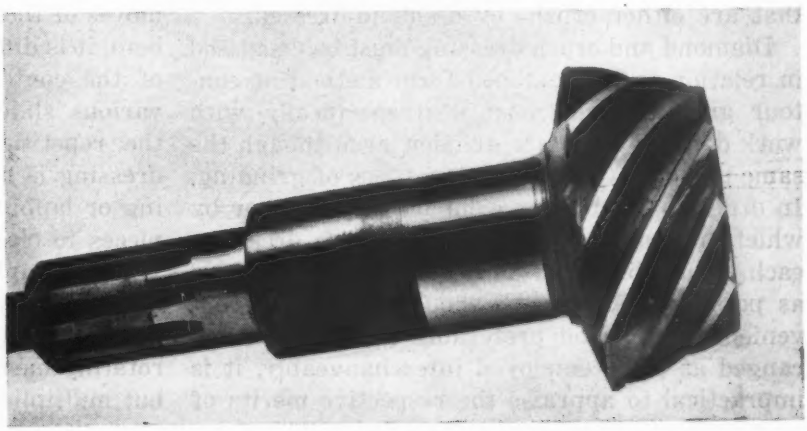
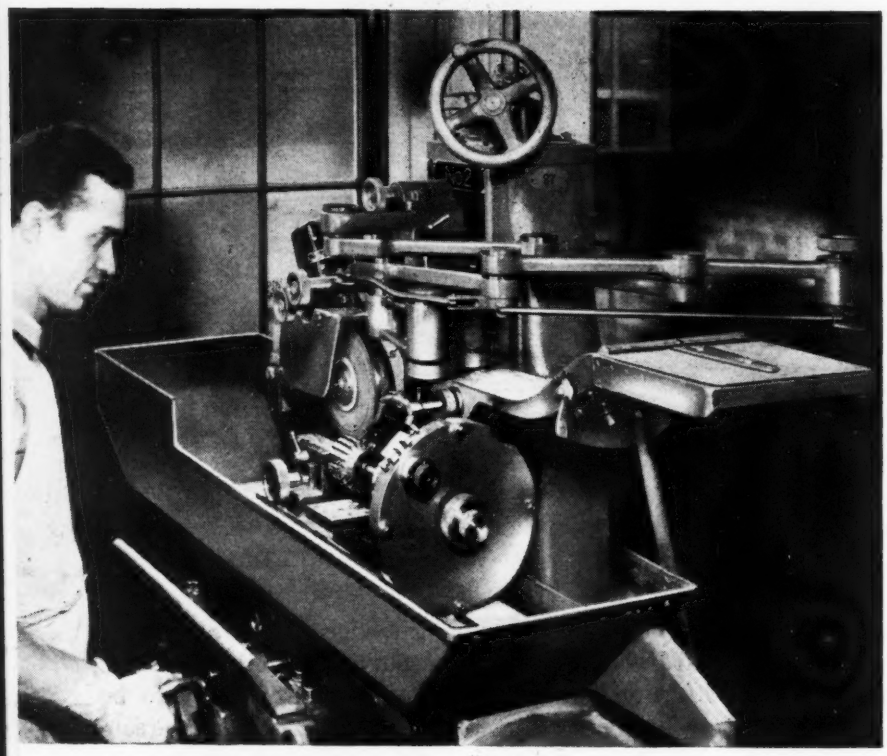


Fig. 5. The Bearing Surface of This Automobile Stem Pinion was Superfinished to Increase the Life of the Needle Bearings it Contacts

Diamond- or Crush-Dressed Wheels



Factors Determining the Choice between Diamond Dressing and Crush Dressing a Wheel for Contour Grinding — Advantages and Applications of Each Method

By FRED VICTORY
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CONTOUR grinding has assumed a position of major importance in modern manufacture. Factors that have contributed directly to this result are the requirement of closer tolerances, greater wear resistance, and economy of production; and the availability of more efficient methods for form grinding, which makes the process practical for a wider variety of applications, including threads, die parts, form tools, and gages.

Basically, contour grinding may be divided into two classifications—generation of the form by movement of the wheel, and grinding of the form by using a wheel dressed to a contour that matches the contour required on the work-piece. Grinding by the matching contour principle is commonly achieved through the use of wheels that are either crush- or diamond-dressed.

Diamond and crush dressing must be discussed in relation to the matched form method of contour grinding and must deal specifically with work done on a surface grinder, even though the same principles apply to other types of grinding. In order to establish a common denominator by which to evaluate diamond and crush dressing, each should be given as nearly ideal conditions as possible. Since each should be equally convenient to use, and preferably should be so arranged as to be employed interchangeably, it is impractical to appraise the respective merits of either wheel-dressing method without considering the types of application, facilities available, and desired results.

Diamond-Dressing Devices

Several devices may be used to produce a contour on a wheel with a diamond tool. For example, the radius and tangent dresser shown in Fig. 1 is a standby in many shops where the volume of contour work is so small as not to justify a greater investment. It can be designed to produce circular as well as straight-line movements in any one of several directions; it is often used to blend radii with other surfaces on a part. However, since the development of a form with such a device is the result of several independent moves of the compound slides and rotating members, it is difficult to blend accurately all portions of the contours. Although stop-blocks on the various slides and rotating members facilitate the repetition of a movement when repeated dressing is necessary, a certain amount of stoning or lapping usually is necessary to finish the pieces to close tolerances.

The simplest type of radius and tangent dresser is limited in scope, but is relatively low in cost. The addition of auxiliary slides and rotating members makes it a more versatile tool, but multiplies the cost and complexity of opera-

for Contour Grinding?

tion; in addition, the dresser seldom can be left in place during actual grinding, since either the work or the dresser usually must be relocated after dressing the form. Hence, even a skilled operator has difficulty in producing repetitive work without some variations in contour.

The pantograph is another mechanism readily adaptable to contour grinding. Although it represents a familiar principle of reduction of movement, it can be used in varied applications where movement of the profile follower either moves a diamond tool to form a contour on the grinding wheel; moves the grinding wheel to form a contour on the work; or positions a microscope which, in turn, determines the position to which the grinding wheel is moved for grinding the work. Because of its inherent accuracy and versatility, as well as the minimum skill required on the part of the operator, the first of these methods will form the basis of the discussion of diamond dressing.

A pantograph of this type should meet the following requirements:

1. Be precision built, so that the contour formed on the wheel does not deviate from that of the templet.

2. Have as large a ratio of reduction as seems practical, 10 to 1 being satisfactory. This ratio reduces errors in the master templet to negligible amounts on the wheel.

3. Be mounted rigidly on the wheel-spindle housing, so that it is always in a fixed relation to the wheel.

4. Have a diamond shaped in the form of a radius, as this presents the strongest possible surface to the wheel and eliminates irregularities, which wear away rapidly. Further, both stylus and diamond should be so mounted that the centers of their respective radii are on their centers of rotation; then angular movement will not cause the tool to dig into or leave the surface of the wheel.

5. Be designed so that an angular movement of the stylus is followed by a similar movement of the diamond tool. This facilitates accurate dressing of steep-sided forms without localizing wear on the tool.

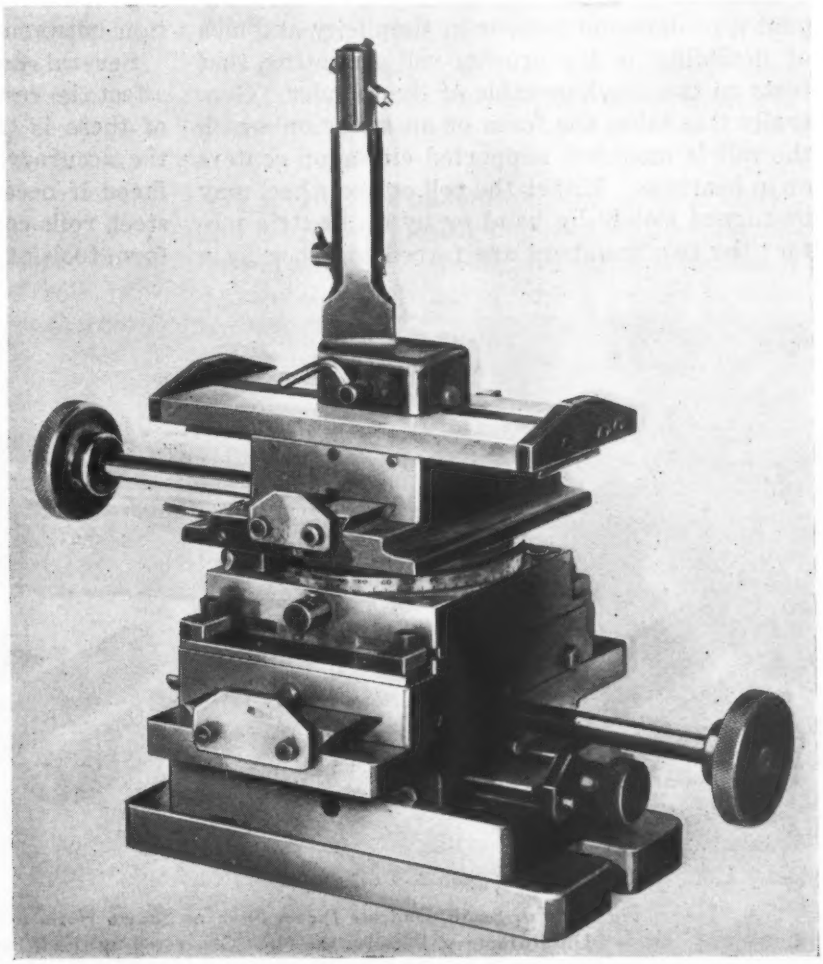


Fig. 1. This Radius and Tangent Dresser is Often Used with a Diamond Tool to Dress Simple Shapes on a Grinding Wheel. It Provides Straight-line Movements in Two Directions, as well as Rotary Motion, Obtained through the Swivel Wheel with Protractor Arrangement

Crush-Dressing Devices

In crush dressing, a cylindrical cast-iron or steel roll is used to crush the wheel to shape. The choice of material for the roll is largely dependent on the means available for originally forming it and the method used to retrue it when necessary.

There is some difference of opinion as to whether the roll should be slotted or smooth. Helical slots, irregularly spaced around the periphery, seem to reduce the crushing pressure. The theory is that these slots provide both an

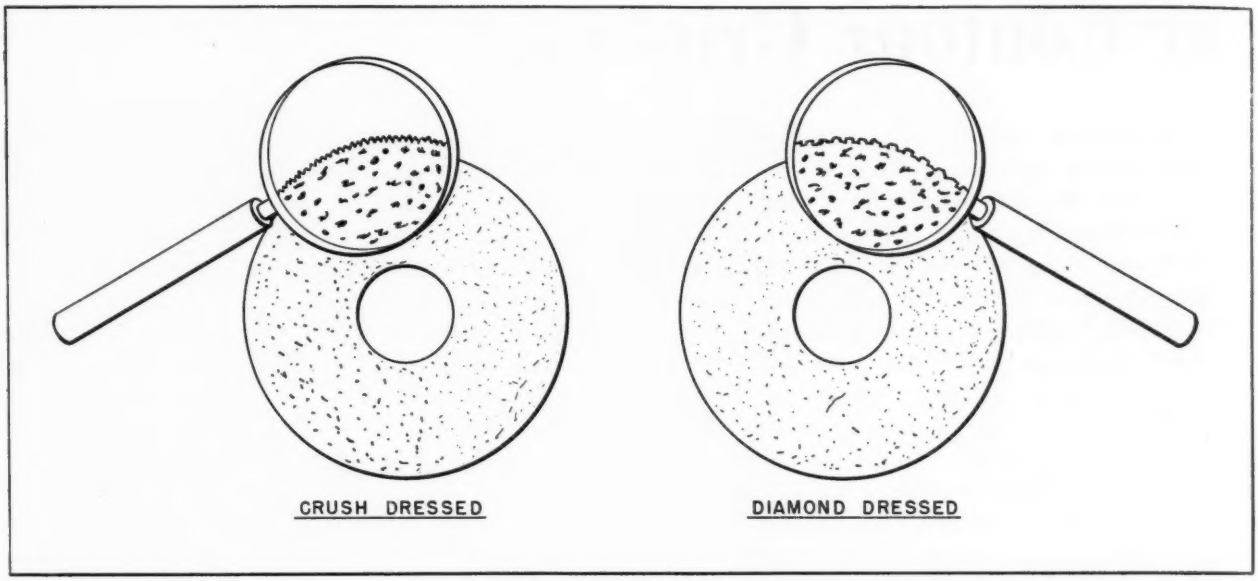


Fig. 2. When Magnified, the Surface of a Crush-dressed Wheel is Seen to Consist of an Uneven Series of Sharp Peaks and Deep Valleys; the Surface of a Diamond-dressed Wheel Consists of a Series of Flat Plateaus

abrading surface and a path for the coolant, thus helping to remove particles from the wheel. The uneven spacing is to prevent "tracking," which would result in bumps on the wheel surface.

Corresponding roughly to the radius and tangent type diamond dresser in simplicity and lack of flexibility is the crusher-roll mounting that rests on the chuck or table of the grinder. Generally this takes the form of an arbor on which the roll is mounted, supported either on centers or in bearings. Either the roll or the wheel may be turned slowly by hand or by an electric motor; the two members are forced together by a down feed of the wheel—one member driving, the other driven by friction. In an elaboration of this device, the roll is mounted on the wheel-spindle housing and provision is made for feeding it into the wheel without disturbing the relation between the contour and the work-piece.

Several factors beyond the basic limitations affect the results obtained in crush dressing One of these is the accuracy of the roll; another is the accuracy with which the roll can be resurfaced if necessary. When made of unhardened steel, rolls can be machined to shape either with form tools or ordinary cutting tools. When made

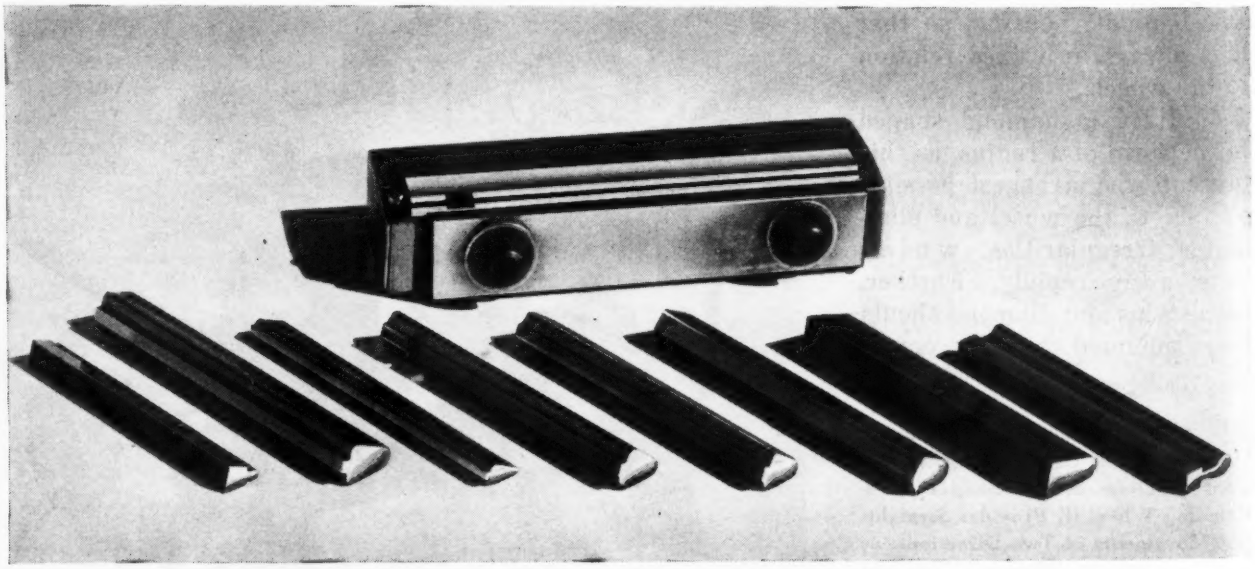


Fig. 3. For Small, Delicate Pieces Such as Shown Here, a Diamond-dressed Wheel is Unsatisfactory, Because the Heat Generated by the Wheel Distorts the Work

of hardened steel, they can be ground. Whichever method is used, the roll should be formed and retrued in position on the bearing on which it is to be used.

Recently a new device has been developed that satisfies the requirements for successful application of both crush dressing and diamond dressing and provides a means for producing the original contour on the hardened roll, as well as resurfacing it when necessary. This mechanism is shown in the heading illustration.

Here, a crusher roll blank is mounted on a reduction-gear motor-driven spindle at one side of the grinding wheel, and a pantograph-actuated diamond tool is mounted at the opposite side. The grinding wheel is first dressed with the diamond, using the pantograph and working from a templet; the wheel then is used to grind the crusher roll to a mating contour The latter step is a cylindrical grinding operation, as the roll is driven on its own spindle.

While this may, at first glance, appear to be somewhat complex in that the diamond is used to form the wheel, which is then used to grind the roll, the latter, in turn, being used to crush the wheel, the converse is true. It actually is an efficient arrangement; since the roll must be formed on some machine, this system eliminates unnecessary steps. The roll is ground directly from the hardened cylindrical blank in position, the time required averaging about nine minutes. Also, it is possible to mount work-pieces, such as circular form tools, in place of the roll, and contour-grind them in position directly from the pantograph diamond-dressed wheel.

A 1/15-H.P., 3600-R.P.M. motor, geared down to about 300 R.P.M. for driving the roll, provides the right combination of speed and power for both cylindrical grinding of the roll and crushing of the wheel, and eliminates the necessity of modifying the grinder. Some crush-grinding fixtures are arranged so that the crusher roll drives the grinding wheel, while in others the grinding wheel drives the crusher roll. As far as results are concerned, neither has a distinct advantage over the other. The problem is, rather, one of machine design and economics. If the grinding wheel is the driver, it must have a slow-speed auxiliary drive; otherwise, the surface speed of the wheel would be so high as to grind a groove in the roll rather than bring it up to speed by friction contact. While this slow speed is not difficult to obtain on modern machines, the crusher roll must be powered, in any event, so that it may be cylindrically ground, and an additional slow-speed motor drive for the grinding wheel is but a duplication.

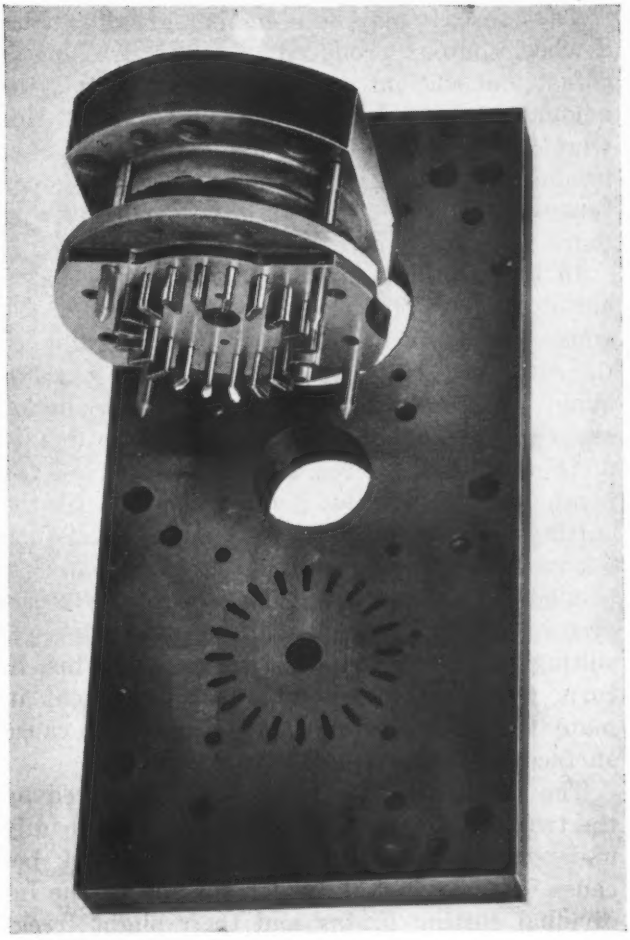


Fig. 4. A Finished Lamination Die Assembled from Parts that are Contour-ground. The Required Accuracy of Contour Makes This a Job for a Diamond-dressed Wheel

To thoroughly understand the relative merits of the types of finish obtained with diamond-dressed and crush-dressed wheels, it is necessary to examine the surface of wheels formed by these two methods. There is a noticeable difference in the surface finish produced by a crush-dressed wheel as compared with the same contour ground with a diamond-dressed wheel. This will be evident from Fig. 2, which shows an enlarged section of two grinding wheels, one of which has been crush-dressed and the other diamond-dressed.

When a wheel is crush-dressed, the grains are loosened from the bond for a certain depth, and, together with the pulverized bond material, are carried away by the coolant. This tearing action leaves a freshly exposed layer of sharp abrasive particles of practically uniform height protruding from the face of the wheel. Each of these grains acts as a cutting tool. Since grinding is a cutting action, efficiency in grinding depends on the sharpness of the tool, which, in this case, is represented by the individual abrasive grits on the wheel surface.

Therefore, it may be seen that grinding with a wheel contour produced by crush dressing is a fast and efficient operation. In addition, the amount of heat generated as a result of this wheel surface condition is so much less than that produced by a dull wheel that much faster stock removal is possible, even in large-perimeter contours on delicate pieces such as shown in Fig. 3.

In the case of a diamond tool, the breaking out of abrasive particles from the surface of the wheel is only incidental to the rough-truing of the surface. The finish-dressing pass of the diamond is actually a cutting action, cleaving or shearing off the projecting abrasive grains to a series of flat surfaces, close to the level of the bond, and to a uniform height. These form the cutting face of the wheel. It is obvious that such a surface will be markedly less efficient than that produced by crushing. The combined surface area presented to the work is much greater, resulting in greater grinding pressures. This, in turn, generates considerable heat, sufficient in many cases to distort delicate parts or to cause surface softness and grinding cracks.

The difference in surface finish produced by the two dressing methods should now be readily understandable. The crush-dressed wheel, because of the relatively wider spacing of the individual cutting grains and their slight irregularity in height, produces a somewhat less finely finished surface than the diamond-dressed wheel.

In addition, a diamond-dressed wheel often can be formed with a higher fidelity of contour than is possible by crushing it to shape. This is particularly true when relatively deep, narrow forms have to be ground and radii at corners have to be held to a minimum.

Another difference in the results obtained with wheels dressed by the two methods lies in the frequency of dressing necessary. Results have shown that crush dressing is required about eight to ten times as often as diamond dressing. This may be attributed to two conditions obtaining in the surface of a crushed wheel—the cutting surfaces are small, and therefore wear rather rapidly for the first few cuts; and some of the individual grains are loosened during crushing and are quickly picked out of the surface of the wheel. These factors directly affect the accuracy with which the contour is crushed on the work. To restate the condition, the wheel starts to break down immediately when it is used.

Summing up the results obtained with the two methods, it is clear that

1. Stock removal with a crush-dressed wheel is faster.

2. Less heat is generated with a crush-dressed wheel, thereby making it more suitable for small, thin pieces that may be distorted.

3. There is some limitation in accuracy and fidelity of contour with a crush-dressed wheel.

4. Certain combinations of abrasive and bond in a wheel, determined by the material in the work-piece, cannot be effectively crush-dressed. For example, resinoid-bonded wheels are too resilient to crush and certain hard, vitrified

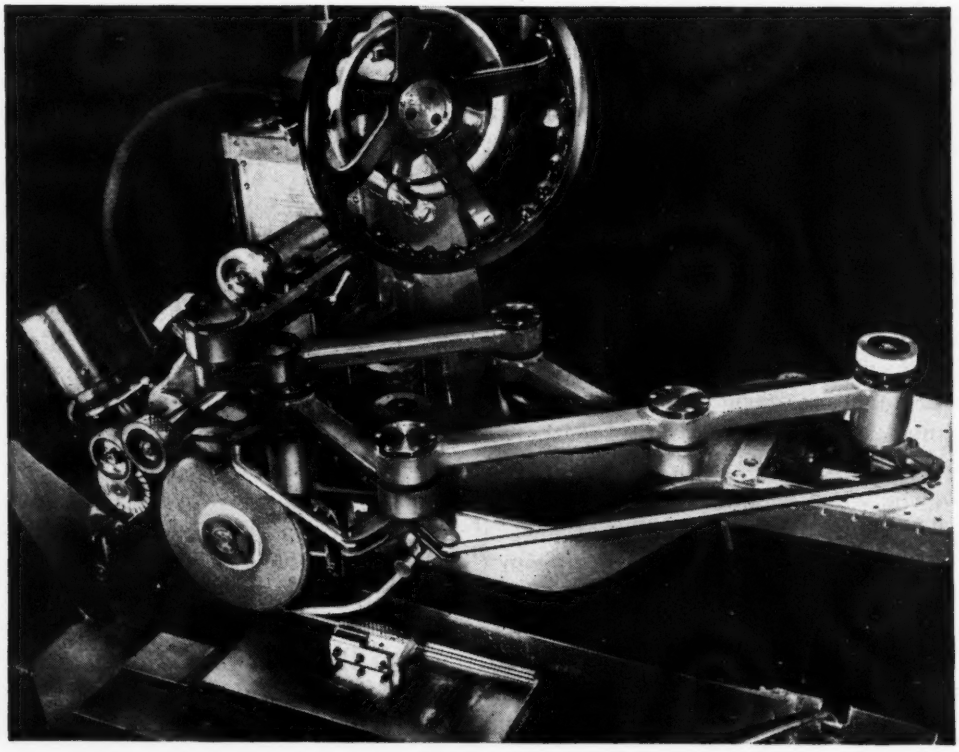
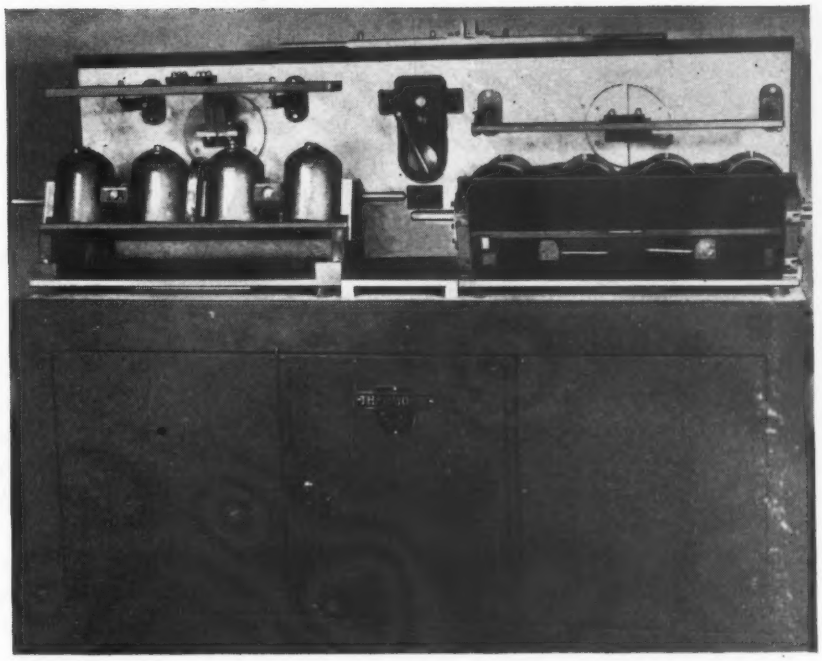


Fig. 5. A Part being Shaped on a Grinder Equipped with a Moore Panto-Crush Fixture—a Device that Combines a Pantograph, a Diamond Tool, and a Crusher Roll



Induction Brazing Removes the Human Element from Specialized Joining Operation on Oil-filter Shells

wheels are so brittle that they crumble and shatter during crushing.

5. A diamond-dressed wheel produces a better finish.

6. Diamond dressing is generally much more accurate, so that more accurate results are obtained in grinding with a wheel dressed by this method.

It is evident from the foregoing that each method has much to recommend it for certain types and phases of contour grinding, and both are necessary in any well rounded set-up for this type of work. When both methods are combined in a single device, the result is the product of the advantages of both, rather than the sum. With such an arrangement, the pantograph diamond-dressed wheel can be used to form-grind the crusher roll, and the crusher roll can then be used to crush the grinding wheel. With the diamond tool readily available for interchangeable use with the crusher roll, maximum convenience and efficiency result.

In operation, the ideal method for most classes of work seems to be to rough-grind the work with a crush-dressed wheel, leaving a few thousandths inch for finish, and bring the pieces finally to size by means of a diamond-dressed wheel. This permits taking full advantage of the fast, cool stock-removing characteristics of the crushed wheel, and at the same time, gives the extreme accuracy and high finish inherent in a diamond-dressed wheel. By utilizing this principle, with whatever modifications are dictated by any special aspect of the job in question, costs are materially lowered and quality of the product is improved.

The Induction Brazing of Oil-Filter Shells

The application of induction heating to the brazing of oil-filter shell assemblies has resulted in increased production with fewer rejections. Three brazing operations are required on each filter—two bushings and a center tube being joined to the shell. First, a 3/64-inch ring of silver solder is placed in each joint, and the entire joint area is cleaned and fluxed. The assembled oil filters are then loaded manually into fixtures on the two-position work-table, and aligned and clamped in place. Air-operated lifting devices raise the fixture, which holds four parts, into the heating coil. The start-button is pushed, and the joint areas of the four oil-filter assemblies are heated to brazing temperature in less than a minute. Since the bushings and center tubes are seated properly in the shells after the alloy flows, a strong, high-quality braze is obtained.

At one position of the work-table, the top bushing and center tube are brazed to the oil filters simultaneously. Meanwhile, the operator loads the second fixture on the work-table in preparation for brazing the single bushing to the side of the shell.

With a Model 1070 20-K.W., high-frequency generator, made by the Induction Heating Corporation, New York City, the production rate for brazing the top bushing and center pipe to the oil-filter shells is 400 per hour; the production rate for brazing the single bushing on the side of the shell is 1200 per hour.

Engineering News

High-Speed Instrument Records Minute X-Rays

An electronic counter that accurately records X-rays at a speed of one-millionth of a second over a wide range of intensities has been developed by research engineers of the Westinghouse Electric Corporation. The device is said to be an adaptation of the photo-multiplier tube. This photo-multiplier tube is wrapped in a sheet of fluorescent screen which, in turn, is wrapped in black paper. While the black paper blocks out all room light, it allows the X-rays to penetrate to the fluorescent screen, causing it to fluoresce —a condition that sets up a tiny electric current in the tube, which is amplified one million times to make possible exact measurement of changes in radiation intensity.

In high-speed tests, the new detector has responded to the smallest X-ray units known. X-rays do not travel in a continuous procession, but are grouped together in packages known as "quanta." Since X-rays can be found in no smaller units, an instrument that responds to quanta is used to record the readings. The development of such a sensitive instrument points the way to further industrial applications of X-rays.

The Heart of a New Meter Developed by Westinghouse Engineers to Measure X-rays over a Wide Range of Intensities is a Photo-multiplier Tube Surrounded by a Fluorescent Screen

New Light-Weight Electrical Wire Used on Airplanes

Electrical wire made with an aluminum conductor and a fire-resistant insulation, known as "Neolay," has been used for the electrical system of a huge Consolidated Vultee bombing plane. Through the use of this wire, there has been a saving of 200 pounds in weight, there being more than 140,000 feet of electrical wire on the plane.

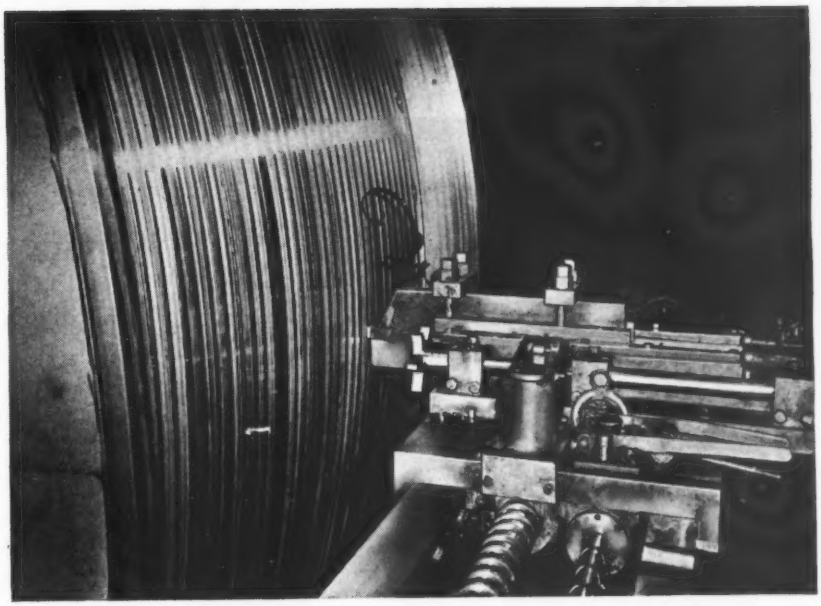
The wire insulation consists of a layer of glass to insure circuit integrity and a fire-resistant synthetic rubber that is applied by a special dipping process. This new electrical wire is a recent development of the United States Rubber Co., New York City.

Tubing Made by "Stretch-Rolling" in Continuous Seamless-Tube Mill

The principle of "stretch-rolling" red-hot steel tubing, a process that permits a substantial reduction in wall thickness and diameter with relatively few roll passes, will be a major innovation in the first continuous seamless-tube mill at the Lorain, Ohio, plant of the National Tube Co.

The stretch reduction process requires the introduction of tension by increasing the relative speed of the rolls in successive stands more than is required merely to roll pipe wall to smaller diameter. The magnitude of this tension, which acts in the direction of the tube axis, is sufficient to stretch the tube, thus resulting in thinner walls and greater length.

The amount of wall reduction can be varied, within limits, by changing the relative speed ratios of the consecutive roll stands. In this manner, finished tubes of a given diameter, but of different wall thicknesses, can be made from the same shell size with no change in the mill setting except speed adjustments on the several motor drives. Area reduction can be varied either by changing the over-all reduction in diameter of the tube through the addition or removal of roll stands or changing the amount of wall re-



Approximately 12 Tons of Metal are Machined from Each Large Mine Hoist Drum Produced by the Bartlett Hayward Plant of the Koppers Co., Inc. Because of Their Size—20 Feet in Diameter and 7 Feet 10 1/2 Inches between Flanges—the Drums are Turned in a Specially Designed Pit Lathe. Machining Consists of First Roughing the Flange Sides and Face, and the Draw Surface, and then Flange Cutting the Grooves, as Illustrated, in which the 2 1/2-inch Mine Hoist Cable is to Lie. Final Finishing of the Grooves is Accomplished with Form Tools having a 1 3/8-inch Radius. Carboloy Tools, which are Held in a Heavy Extension Bar-holder for Maximum Support, are Used in All Operations

duction through adjustment of roll-speed ratios, or by a combination of both.

Conditions inherent in the process limit the maximum diameter of a tube that can be stretch-reduced to about 3 inches outside diameter. The process is best suited for sections from 3/8 inch to 2 inches in diameter, with walls ranging from 0.08 to 0.20 inch.

Blast Holes Made Ten Times Faster with Fusion Piercing

A new process that is said to reduce drilling time on low-grade iron ore to one-tenth that formerly required has been tested recently on the Mesabi Iron Range. Developed by The Linde Air Products Co. for making vertical blast holes, the fusion-piercing process utilizes a special blowpipe through which is forced burning oxygen and a flux-bearing fuel. The high flame temperature—about 4000 degrees F.—and the flux in the fuel combine either to melt or spall the rock and thus release burning gases that force the molten material past a water spray, where it is quenched and broken up. During quenching, the water turns to steam, which further aids the gases in forcing the quenched material above ground.

Several test holes, 6 inches in diameter and up to 30 feet deep, have been fusion-pierced in "Taconite" (an extremely hard, tough low-grade iron ore) at an average rate of 10 feet an hour. In addition to increasing the speed of blasting, it has been found that the high-temperature flame produces stresses that cause better fragmentation in surrounding ore during primary blasting.

Liquid-Oxygen Fuel Increases Power of Aircraft Engines

The output of a 2000-H.P. engine designed for military aircraft has been increased approximately 300 B.H.P. by using a method of liquid-oxygen injection developed by the Aeronautical Engine Laboratory of the Naval Air Materiel Center at Philadelphia in cooperation with the National Bureau of Standards and the De Laval Steam Turbine Co. Described by Francis Masi, Ernest Fiock, and Robert Grosselfinger at the Aeronautical Meeting of the Society of Automotive Engineers in Los Angeles, the method is used in combination with water injection, and is said to be limited only by the engine cooling capacity. Increases can be maintained for a substantial period of time—sixteen minutes in the case mentioned—with apparatus which weighs but 80 pounds, and can be readily adapted to existing power plants. The only disadvantages are the lack of availability of liquid oxygen and its tendency to accelerate the combustion rate in case of fire.

An Instrument that Measures Composite Opinion

An instrument designed to indicate the composite opinion of groups comprising as many as 120 individuals has been developed by the General Electric Co. This instrument enables each person in a group to express secretly, in degree, his opinion on any subject. All of the individual opinions are totaled on a large dial in about ten seconds. From 0 to 50 is considered the "no" side of the dial, and from 50 to 100 the "yes" side.

"Heat Gun" Makes Possible New

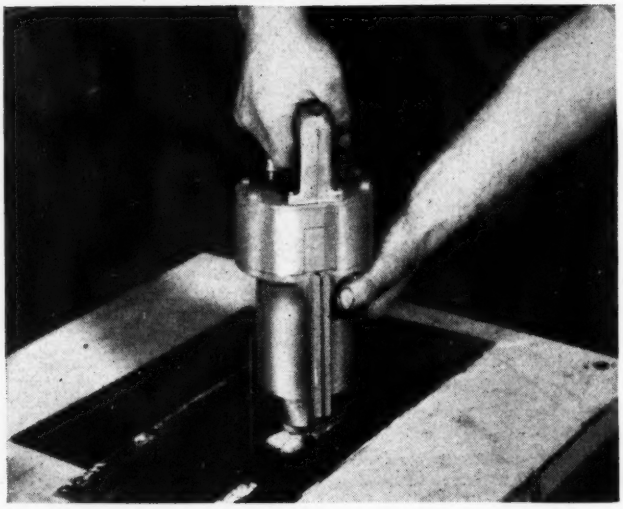


Fig. 1. Performing a Silver-soldering Operation on Sheet Steel with a Tocco "Heat Gun"

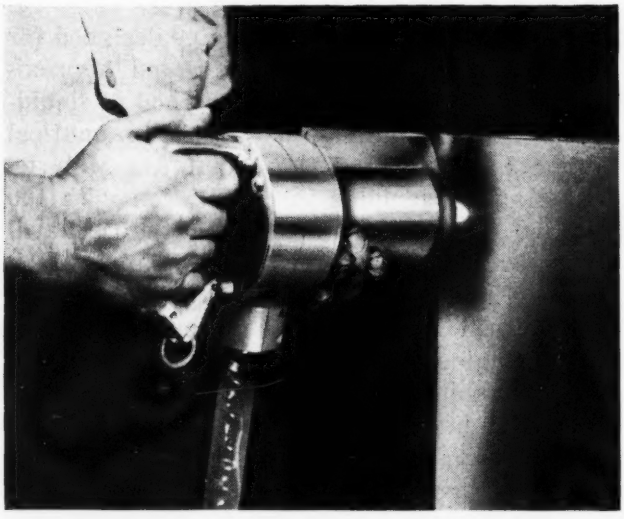


Fig. 2. Lap-brazing Operation on a Steel Box

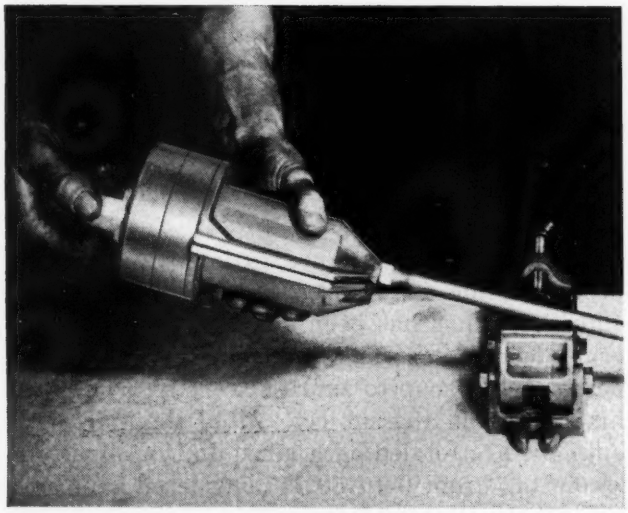


Fig. 3. Heating the End of a Steel Bar for Hardening

By J. W. WILLIAMSON, Research Engineer
Tocco Division, Ohio Crankshaft Co.

THE Tocco "Heat Gun" shown in use in the accompanying illustrations was first displayed last November at the National Metal Congress in Atlantic City. The possibilities of this new portable induction heating device, described and illustrated in December, 1946, MACHINERY, page 194, have already attracted widespread interest. The purpose of this article is to explain some of these possibilities, but first it will be well to review briefly the outstanding features of the "Heat Gun."

The "Heat Gun" consists essentially of a portable inductor coil designed for heating functions similar to those ordinarily performed by soldering irons and oxy-acetylene torches. However, since the heat is generated within the work-piece itself, the "Heat Gun" can perform this work much faster. Furthermore, with the new heating device, the danger of explosion incident to the use of an open-flame torch is eliminated, the operator is not compelled to wear dark glasses, and no preheating adjustment or control of any kind is required.

The ease with which the device can be employed for silver-soldering operations on steel sheets will be apparent by referring to Fig. 1. For this work, the operator simply places the nose of the gun against the piece to be heated and pulls the control trigger. This connects the gun electrically to a 9600- or 10,000-cycle generator which provides the required power. Attention is called to the fact that small spacers on the nose of the gun prevent actual physical contact between the inductor and the work.

The induced currents produce heat in the same way that heat is generated by current flowing through the filament of a lamp. The principle of operation is well illustrated by interposing a piece of cloth between the piece to be heated and the gun. Since the cloth is not an electrical conductor, it is unaffected by the gun. However, the work-piece becomes heated in a few seconds.

The Tocco "Heat Gun" weighs only about 8 pounds, and the current-carrying leads or cables are sufficiently light and flexible to permit easy handling by the operator. A run of 20 feet from the generator to the work is practical, and a longer run could be used if necessary. The gun is held in the operator's bare hand. No high-voltage hazard exists in its operation, and the

Applications of Induction Heating

gun remains cool, both thermally and electrically. While equipment having a larger capacity is sometimes desirable, a generator rated at 7 1/2 kilowatts supplies sufficient power for heating the work in about half the time usually required with an oxy-acetylene torch.

In plants performing job-shop types of operations, where short runs of varied parts prevail, the Tocco "Heat Gun" will often eliminate the necessity of providing a special inductor heating coil or inductor block for each job. Thus the advantages of induction heating are obtained without an excessive outlay for equipment, and no time is lost in changing over from one job to another. Also, the use of flexible leads permits employing the gun in corners where it would be inconvenient and awkward to use rigid leads or stationary inductors. When large assemblies are to be treated, the "Heat Gun" can be taken to the work instead of bringing the work to the heating equipment.

The Tocco "Heat Gun" is still new, and many of the applications found for it have been suggested by customers. Some of these applications are shown in the illustrations. Fig. 2 shows a lap-brazing operation on a large steel box. A strip of silver solder is placed between the two sheets of metal to be joined. The operator then moves the gun continuously along the seam of the box.

Fig. 3 shows the "Heat Gun" being used to heat the end of a steel bar, 1/2 inch in diameter, for hardening. This operation required only four seconds. Fig. 4 illustrates the heating of a pin for an upsetting operation, the required heat being obtained in six seconds. The gun successfully heated this pin and other sizes ranging from 1/4 inch to 1 1/4 inches in diameter, whereas two or more inductor coils of the standard stationary type would have been required for this work. Fig. 5 shows how a piece of 5/8-inch bar stock is heated for bending in only fifteen seconds.

Silver-brazing of carbide tips to the shanks of large lathe tools is also accomplished efficiently with the "Heat Gun," such operations requiring only thirty-five seconds. Fig. 6 shows the gun being used for annealing the edge of a large pipe section prior to machining. The time required for heating this 18-inch diameter flame-cut pipe end was only four minutes.

From the examples illustrated, it is apparent that the Tocco "Heat Gun" can be used for a wide range of heating jobs.

Fig. 4. Using the "Heat Gun" for Heating a Pin prior to Performing an Upsetting Operation

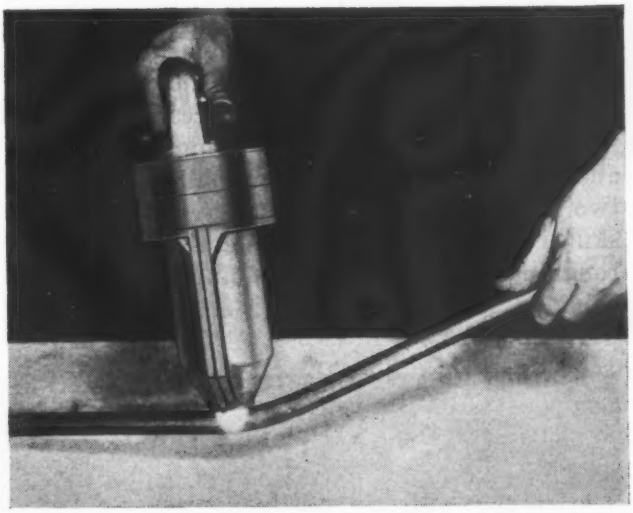


Fig. 5. Heating Bar Stock for Bending Operation

Fig. 6. Annealing Flame-cut Pipe End with "Heat Gun"

Materials of Industry

THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

Starrett Ground Flat Stock for Precision Parts

The L. S. Starrett Co., Athol, Mass., is now making available two types of precision ground flat stock. One is an oil-hardening, non-deforming electric furnace tool steel. It is spheroidized-annealed, and has fine grain structure and deep hardening characteristics suitable for precision parts requiring accuracy of size after hardening. The other is a high-grade tool steel, annealed for easy machining, which develops maximum hardness when quenched in water or brine.

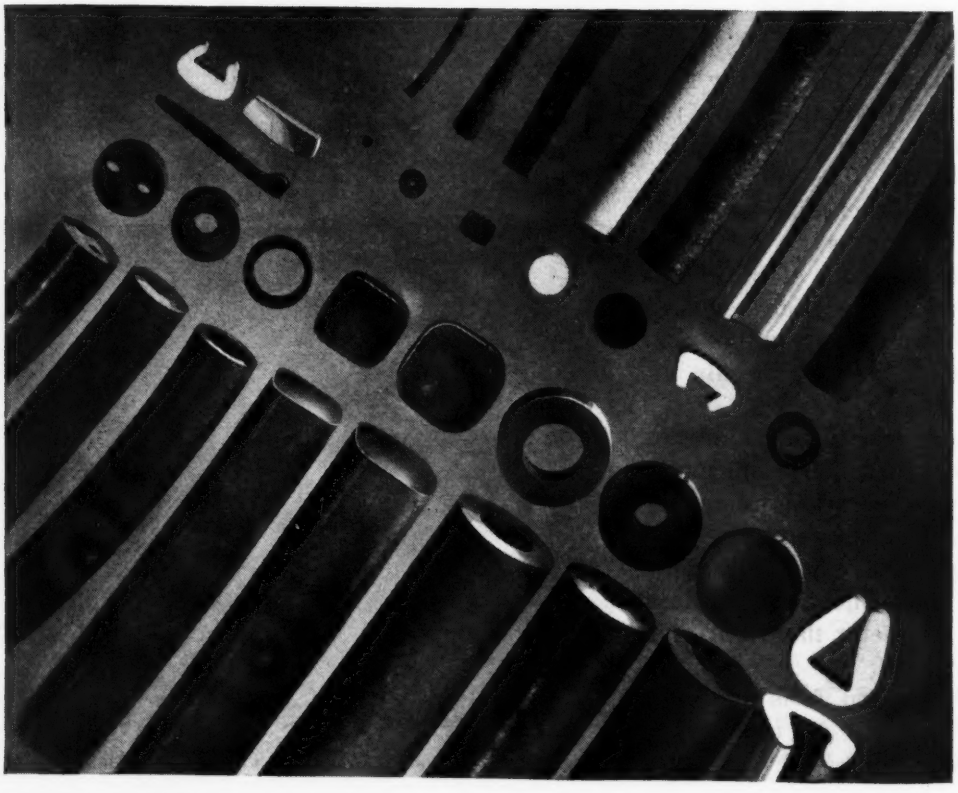
This stock is designed to expedite the production of precision parts and pieces such as die parts, flat gages, drill jigs, templets, machine and fixture parts, and other small parts having two flat parallel surfaces. It saves the time of skilled toolmakers and diemakers by eliminating roughing and precision grinding prior to machining. 201

Silicone Rubber Finds Increasing Applications

Increasing use of silicone rubber manufactured by the General Electric Co., Pittsfield, Mass., has resulted from improved molding and fabricating techniques. Silicone rubber is noted for its ability to remain practically unaffected when subjected to temperatures ranging from —55 up to 520 degrees F. It is also highly resistant to chemicals and moisture, and has excellent electrical insulating properties.

One of the uses for silicone rubber is as gaskets in high-temperature equipment such as Diesel engines, gas turbines, air compressors, and other equipment where natural and synthetic rubbers cannot withstand the high temperatures to which they are subjected, and have undesirable permanent set characteristics. In new Diesel-engine locomotives, silicone rubber gaskets are being used between the supercharger and the Diesel-engine block, where a soft resilient stock is required to give positive gasketing action at 300 degrees F. and 15 pounds air pressure. The non-adherence of silicone rubber to metal and other materials at high temperatures is an important feature in gasket applications.

Silicone rubber is being made available in extruded shapes, molded parts, sheet form, and fabricated



Extruded Tubes, Rods, and Fabricated Stock Made from Silicone Rubber by the Plastics Division of the General Electric Co.

stocks. Sheet stock can be reinforced with plies of glass and asbestos cloth to give greater strength. Molded parts can be made in any of the conventional types of compression molds, and are now being produced in increasingly intricate shapes. Silicone-rubber coated glass cloth is also available. 202

Ground Flat Tool Steel for Dies, Jigs, Gages, Etc.

A ground flat carbon tool steel has recently been announced by Marshall Steel, 228 N. La Salle St., Chicago 1, Ill. This steel is furnished in a form which eliminates much of the need of cutting to size, shaping, or planing, and finish grinding. It is fully annealed for easy machining. Heat-treating is accomplished by standard procedures, using either brine or oil quench. The steel is suitable for such products as templets, models, dies, jigs, shims, and gages. 203

Automobile Bumpers Can Now be Made of Stainless Steel

Automobile bumpers and other accessories formerly made from chromium-plated steel or die-castings can now be successfully fabricated from stainless-clad steel, according to Fred T. H. Youngman, president of the Jessop Steel Co., Washington, Pa. Experiments in the application of Jessop stainless-clad steel to automobile and truck parts were begun several months ago, and development work is now completed. The stainless-clad steel supplied by the Jessop Steel Co. for these experiments was made with 10 to 20 per cent stainless cladding on a mild steel backing, although stainless-clad sheets and plates with 5 to 50 per cent stainless cladding are also available. The stainless cladding, of controlled thickness, is united to the mild-steel backing during the hot-rolling process, and cannot separate, even under severe bending operations.

Bumpers, bumper guards, gravel guards, and other automobile parts made from stainless-clad steel will not chip, flake, or peel, and will maintain a permanently rust-free surface. The stainless cladding can be polished to a high finish, and will retain its pleasing appearance during the life of a vehicle. 204

Hot-Tank Cleaning Compound for Metals

A low-cost, non-inflammable hot-tank cleaner that effectively removes carbon and paint, as well as grime, grease, gums, heat-hardened resins, and heavy dirt, from steel and other ferrous metals without the necessity of scraping or other manual methods has recently been introduced by Turco Products, Inc., 6135 S. Central Ave., Los Angeles, Calif.

It is claimed that the superior carbon and paint stripping qualities of this new product, known as "Ferrex," result from a combination of two cleaning agents—Ferrex B, an alkaline solid, and Ferrex C, a direct-action liquid solvent. This cleaning compound is specifically designed for use on steel, cast iron, bronze, copper, and red brass. It utilizes a water solution and a simple hot tank, preferably with air agitation, to penetrate and "wet out" carbon smut and lead deposits, emulsify petroleum residues, and saponify animal and vegetable oils. 205

To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on these pages, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning name of material as described in April, 1947, MACHINERY.

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Forming Sheet-Metal Cabinets

By CYRIL J. BATH, President
The Cyril Bath Co., Cleveland, Ohio

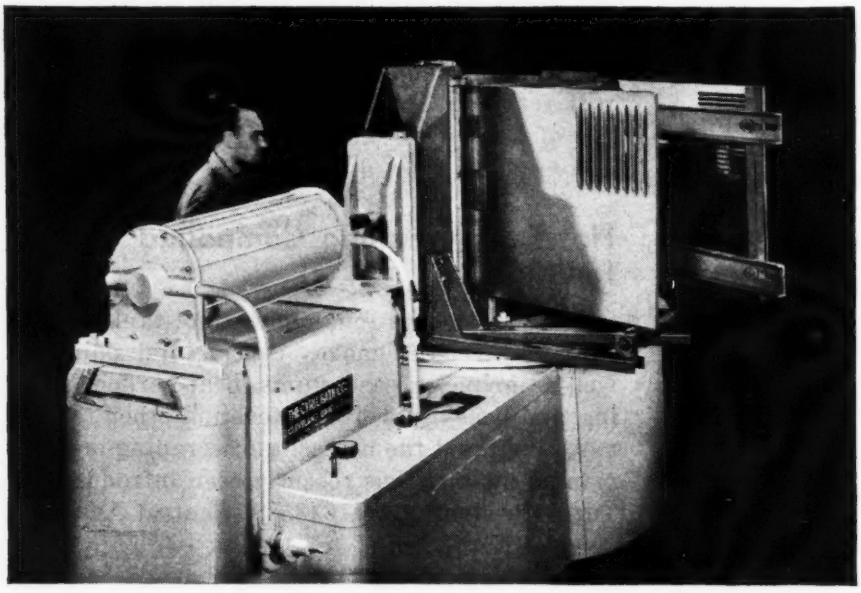


Fig. 1. Cyril Bath Modified Contour Former Equipped for Forming Three Round-top Metal Cases a Minute

IN June, 1940, one of the first of a line of machines known as "Tangent Benders," was built by the Cyril Bath Co., for use in the manufacture of one-piece metal cabinets. Since that time this company has developed special machines for making a variety of products, ranging all the way from small metal cabinets to major parts of railroad cars and transport planes. Similar means have also been employed for forming steel and aluminum alloys which do not lend themselves readily to conventional die applications. Shapes can be produced in one piece by the "tangent bending" method that could not be formed on presses.

The original tangent bender was built to form the crown and rounded corners of a typical domestic refrigerator cabinet by sweeping the metal around the bending form. It is on this type machine that the majority of domestic refrigerator cabinets now being built are pro-

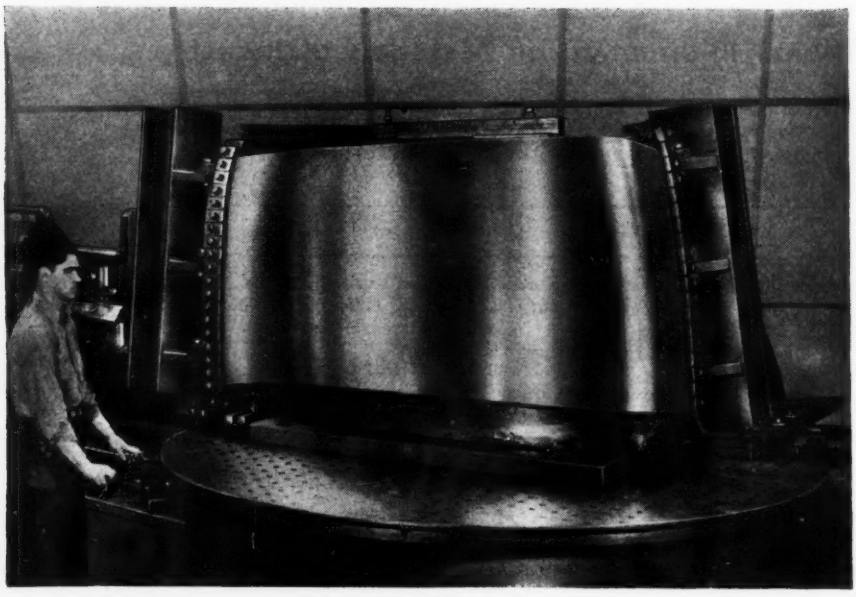


Fig. 2. Contour Forming Machine Designed for Use as a Metal Sheet Stretcher

duced. However, it was soon found that this particular application was limited, as many high-alloy metals could not be formed to the desired radii because of difficulty experienced in compressing the material in contact with the bending form. It became apparent that such parts must be produced by a combination stretching and tangent-bending or sweeping operation. As the result of development work aimed at producing a more general-purpose machine, the present universal contour forming machine was ultimately designed.

This machine will perform a wide range of operations, from straightening a curved bar to curving a straight bar or winding a straight bar into a coil. It will form shapes to any kind of free-hand curve, and it will compel materials like high-alloy stainless steel, which "works" about as readily as a watch-spring, to conform to die shapes. This machine is just as effective on ST aluminum, and it will easily handle sheets up to 48 inches in width. On certain types of work well adapted to its function, it operates successfully as a production tool, and will form work which is contoured in two planes. Once a part has been produced satisfactorily, and the best method of manufacture on the contour forming machine has been established, the operation can be transferred to a single-purpose production tool quite readily.

In Fig. 1 is shown a modified contour former which is capable of making round-top metal cases at the rate of three a minute. The same type case could be made with a front to back crown by stretching the metal around one of the standard contour formers. This, however, would be slower and would involve the trimming away of the material held in the stretch jaws. A contour former that is being used as a metal sheet stretcher is shown in Fig. 2.

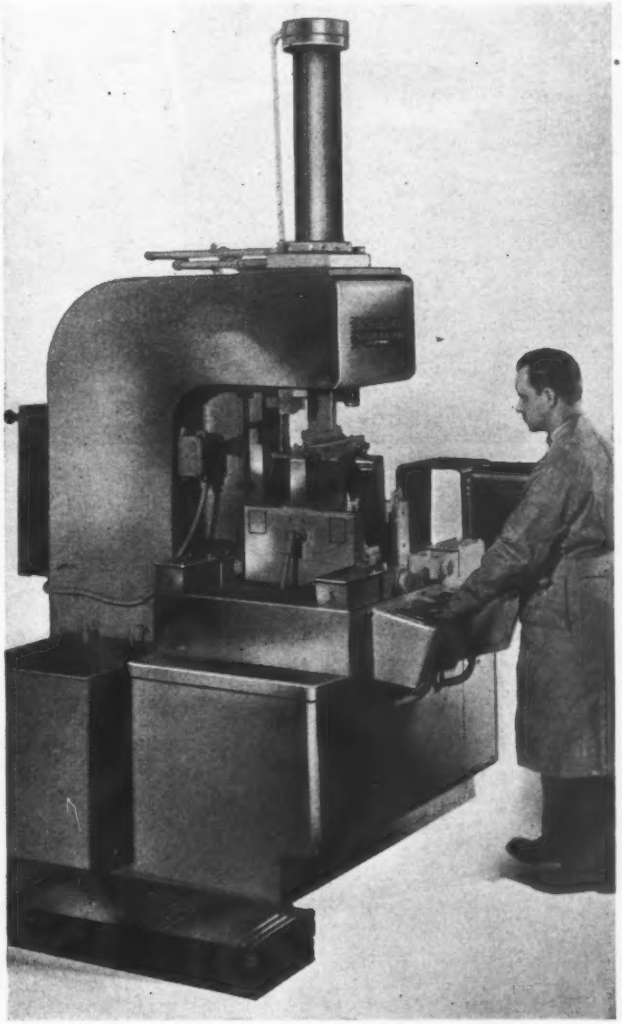
A typical illustration of a rapid production job on a specially designed machine is shown in Fig. 3. This high-speed vertical hydraulic cabinet-making machine is producing, in this instance, a small ventilated cabinet. Prior to this operation, the flat formed sheet is produced in one stroke on a crank press. It then passes to the vertical cabinet machine, which completes from three to five cabinets a minute.

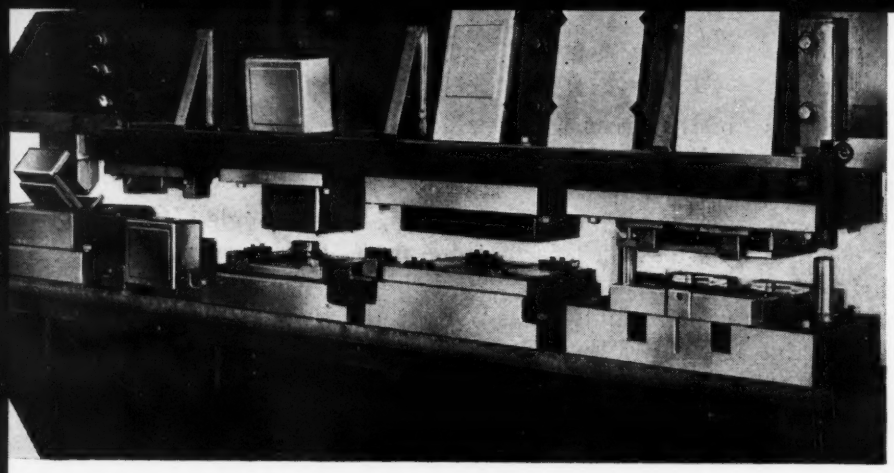
This vertical tangent bender is provided with hand safety push-button controls and automatic stripper. In order to keep the corners free from wrinkles, a pressure of 15 tons is required on the vertical hydraulic cylinder, which is driven by a two-pump system giving high speed during the idle stroke and high pressure during the operation. The work is all performed in one stroke of the press. The principal function of the side cylinders is to apply adequate pressure to the wiping dies.

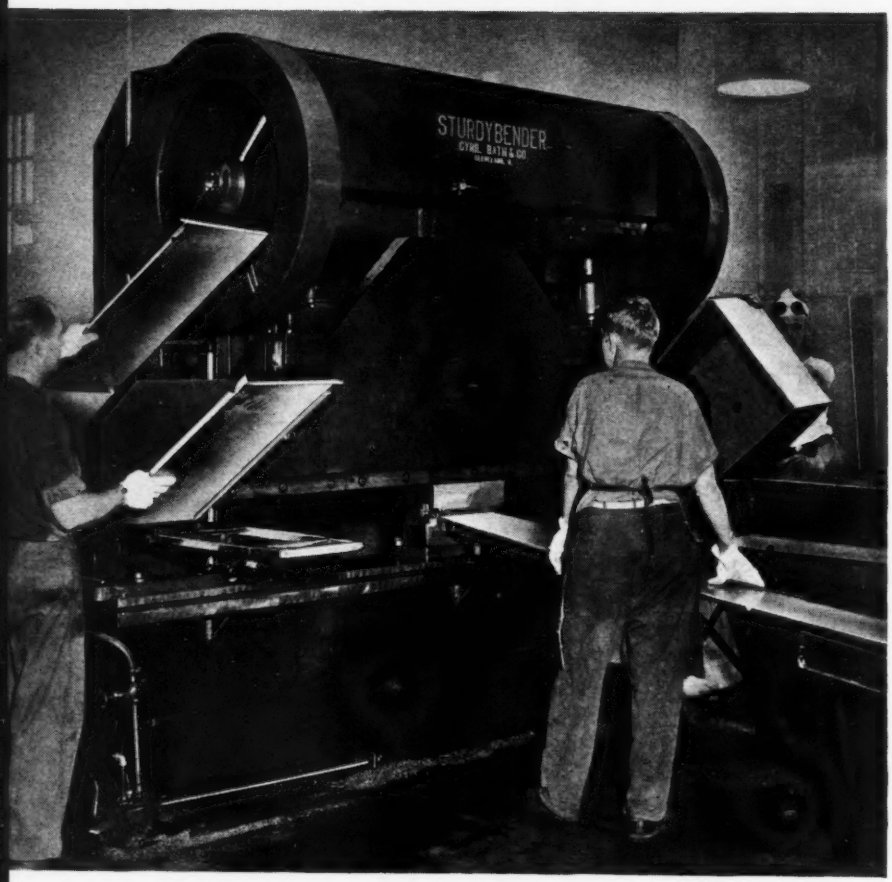
The center part of the three-piece single-action die used in this machine first forms a crown of moderate dimensions, following which the side wings simultaneously form the sheet around the radius of the punch. Work can be formed to a radius as small as 1 inch, for example, by this method, and it can be formed to a curve composed of more than one radius.

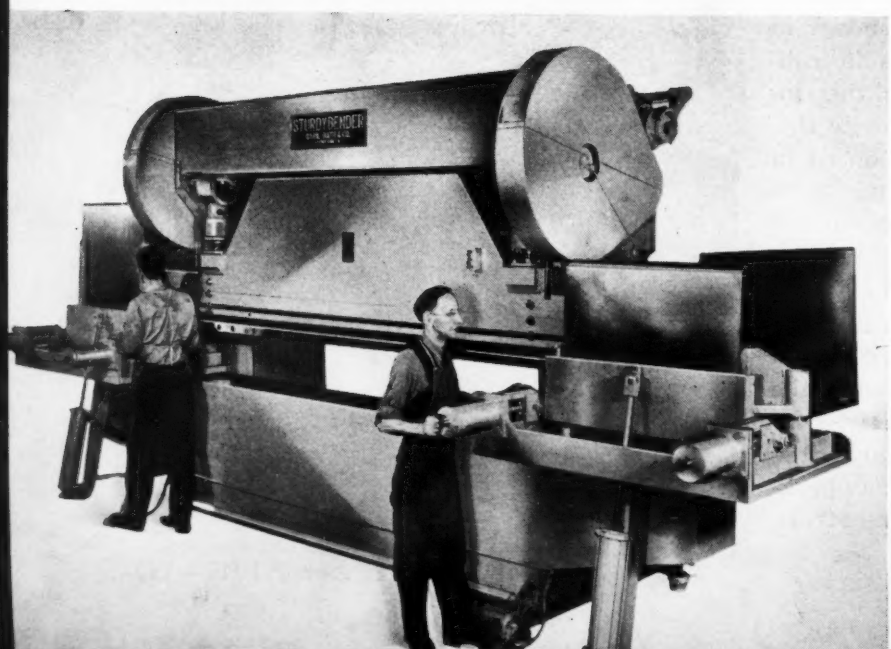
The vertical machine requires comparatively little floor space, and is well suited to work that can be readily handled by one man or to those types of cabinets in which all four corners are formed to make a completed rectangular case, as for instance, in home freezer units, the food chamber in domestic refrigerators, or individual heater cases. The same type of machine is made double-ended, the second end being a horning

Fig. 3. Vertical Type Hydraulic Machine of Special Design Equipped for the Rapid Production of Small Ventilated Cabinets









type member for forming closed boxes.

Fig. 4 shows a standard bending brake with a series of special dies arranged for the manufacture of the familiar telephone bell case. In Fig. 5 is shown a standard "Sturdybender" brake with overhanging ends used with a special work-supporting member for making the food chambers in a typical domestic refrigerator. Fig. 6 shows a special "Sturdybender" with extra wide bed and overhanging ends, equipped with tangent bending dies for the manufacture of freezing cases.

A fairly complex development of the cabinet-making type of machine, with dies that can be collapsed for loading, is illustrated in Fig. 7. This illustration shows the machine with the cabinet completed and in the unloading position. The cabinet had an inner flange to be formed parallel to the crown. The work involved a series of eight movements during a single cycle of the crank. These movements originated at a remote control station. The machine, which is the latest design of "Tangent Bender," can be manually operated for each individual operation or it can be operated automatically, with the various movements in their proper sequence.

Fig. 4. (Top) Standard Bending Brake with Series of Special Dies Arranged for the Manufacture of Telephone Bell Cases

Fig. 5. (Center) "Sturdybender" Brake with Overhanging Ends Used with Special Work Support for Making Food Chambers for Domestic Refrigerators

Fig. 6. (Bottom) Special "Sturdybender" Brake with Extra Wide Bed and Overhanging Ends Equipped with Tangent Bending Dies for the Manufacture of Freezing Cases

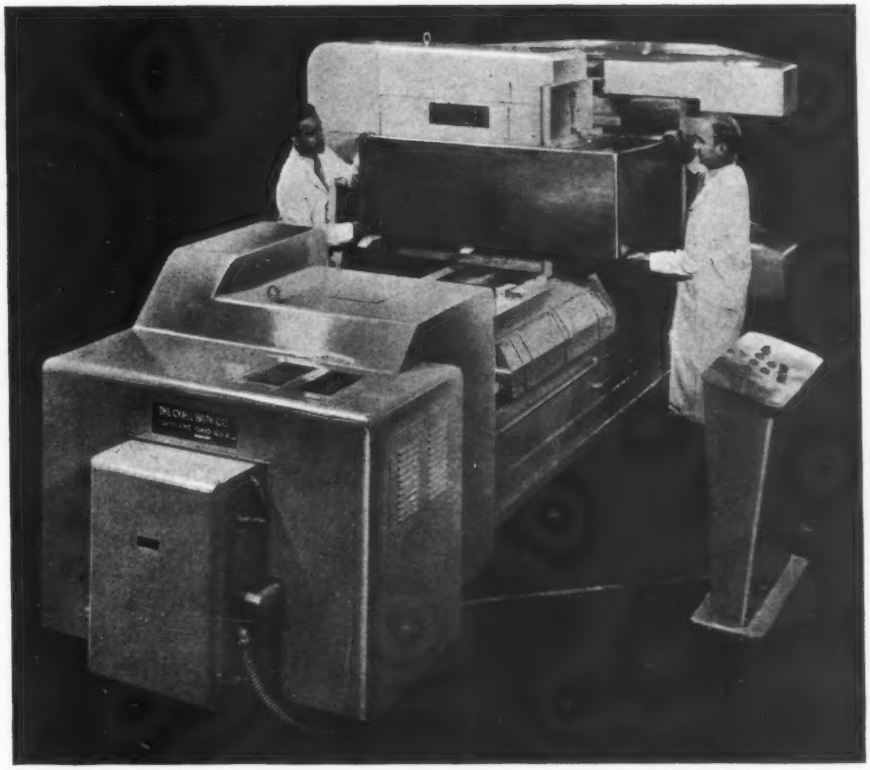


Fig. 7. Bath Cabinet-making Machine that can be Controlled Manually for Each Individual Operation or Used as a Fully Automatic Machine

A distinguishing feature of this machine is that all motions are made in one cycle of the crank. Other outstanding features include higher production and simpler means for changing dies. The action of the corner wings of this machine produces a slight sliding motion, giving an ironed finish to the corner and a somewhat superior product. The machine is not only heavier and faster than previous models, but is also more adaptable and simpler to maintain and operate. The machines described are all adapted to long production runs on standardized products.

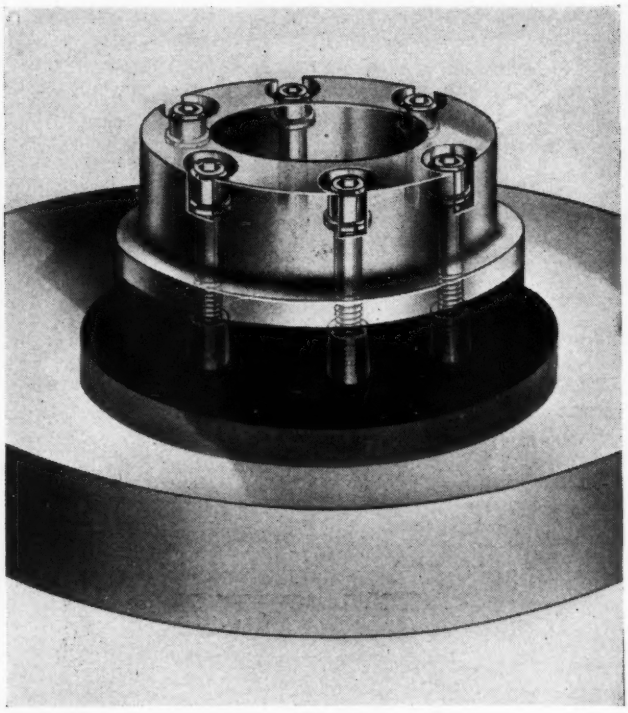
Carbide Parts with Drilled and Tapped Holes for Fastening Screws

THE development of carbide parts with solidly embedded machinable materials that permit drilling and tapping for fastening screws or studs has just been announced by the Carboloy Company, Inc., Detroit, Mich. The new development makes it possible to attach carbide parts with screws, studs, bolts, or other means as easily as similar parts made of softer metals, such as steel, bronze, cast iron, and aluminum, are secured. This is particularly useful where large carbide sections are employed.

The machinable materials can be solidly embedded in the carbide parts wherever they are to be threaded. Thus it is possible to drill and tap blind holes in the side of the carbide part that is to be attached to some other member. This means that large carbide "wear" parts can be bolted down rigidly, and yet present an unbroken "wear" surface having no through holes.

When it is desired to attach carbide parts by means of studs, screws, etc., the approximate location of the point or points of attachment and the number of such points are first determined. The carbide part is then provided with machinable inserts at those points, which can be drilled and tapped either by the Carboloy Company or by the user. Although just announced, this method has been in actual manufacturing use for some time on both small and large parts.

Among the wide variety of potential applications which may be mentioned are compound, progressive, and segmental dies, particularly those in which blanking operations are performed; "wear" parts and fixtures; crank guides; cams; liners for molds; punches for stamping and other work; machine ways, guides, work-rests, and shoes; and "wear" plates on precision instruments. In die applications, the



ability to attach carbides with threaded parts has the important advantage of permitting the carbide to be seated solidly against the back-up metal, thus greatly increasing impact resistance as compared with similar parts that are attached by brazing.

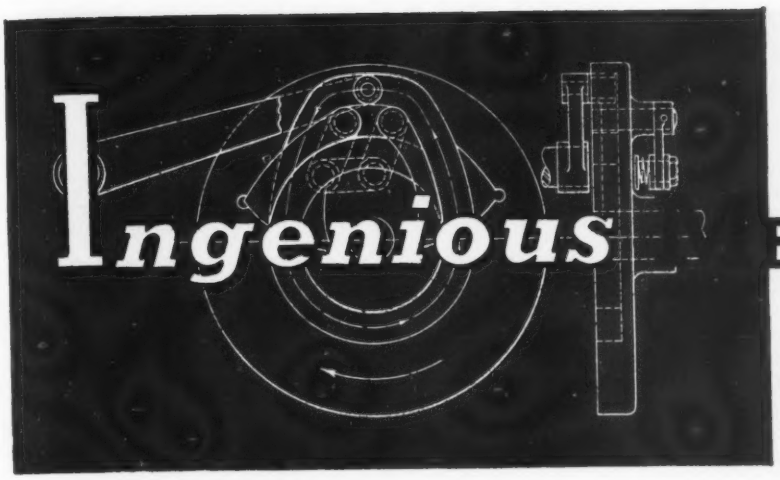
A threaded blind hole can be employed for mounting parts as small as 5/16 inch in diameter by 3/8 inch thick, such as replaceable carbide punch ends. Repeated tests have shown that the maximum pull exerted in tightening the screw, bolt, or stud in an insert does not pull out the metal or damage the thread. It is said that the bolt will actually fail in tension before it either "pulls" the metal or injures the thread. Usually when a bolt has failed in this manner, the portion in the thread can be readily unscrewed and a new one inserted.

In Fig. 1 is shown a Carboloy punch and die set for blanking and forming, in which the points of attachment are indicated by phantom views. This arrangement provides a solid steel backing for the carbide punch which serves to increase its shock resistance.

Fig. 2 shows a five-stage Carboloy progressive lamination die set, the die members for the first, second, and third stages being attached to the steel die-block by the new Carboloy attachment method. The points of attachment, which have machinable inserts, are indicated by lighter toned spots above the drilled and tapped holes provided for the fastening studs. The large punch for the first stage and the two punches for the third stage are also attached by this method. All working parts of the die set are of Carboloy cemented carbide, including dies, punches, die pins, and locating pins.

Fig. 1. (Above) Carboloy Blanking and Forming Die with Carbide Punch Secured to Steel Backing Member by Studs that are Screwed into Drilled and Tapped Machinable Metal Inserts Located in Upper Side of the Carbide Punch Member

Fig. 2. (Right) Five-stage Progressive Lamination Die with Punch and Die Members of Carboloy Provided with Drilled and Tapped Inserts for Fastening to Steel Punch and Die Blocks



Ingenious MECHANISMS

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and other Devices

Helical-Gear Indexing Mechanism

By CHARLES F. SMITH

Helical gears modified as shown in the accompanying illustrations can be used directly for indexing. With the arrangement shown in Fig. 1, shaft *A* will be indexed one revolution for every four revolutions of the driving gear *B*. In other words, shaft *A* will be indexed through an angle of 90 degrees during one revolution of the driving gear. The frequency of the indexing can be increased, with a corresponding decrease in the amount of rotation of shaft *A* per indexing, by increasing the number of slots *C* in gear *D* and

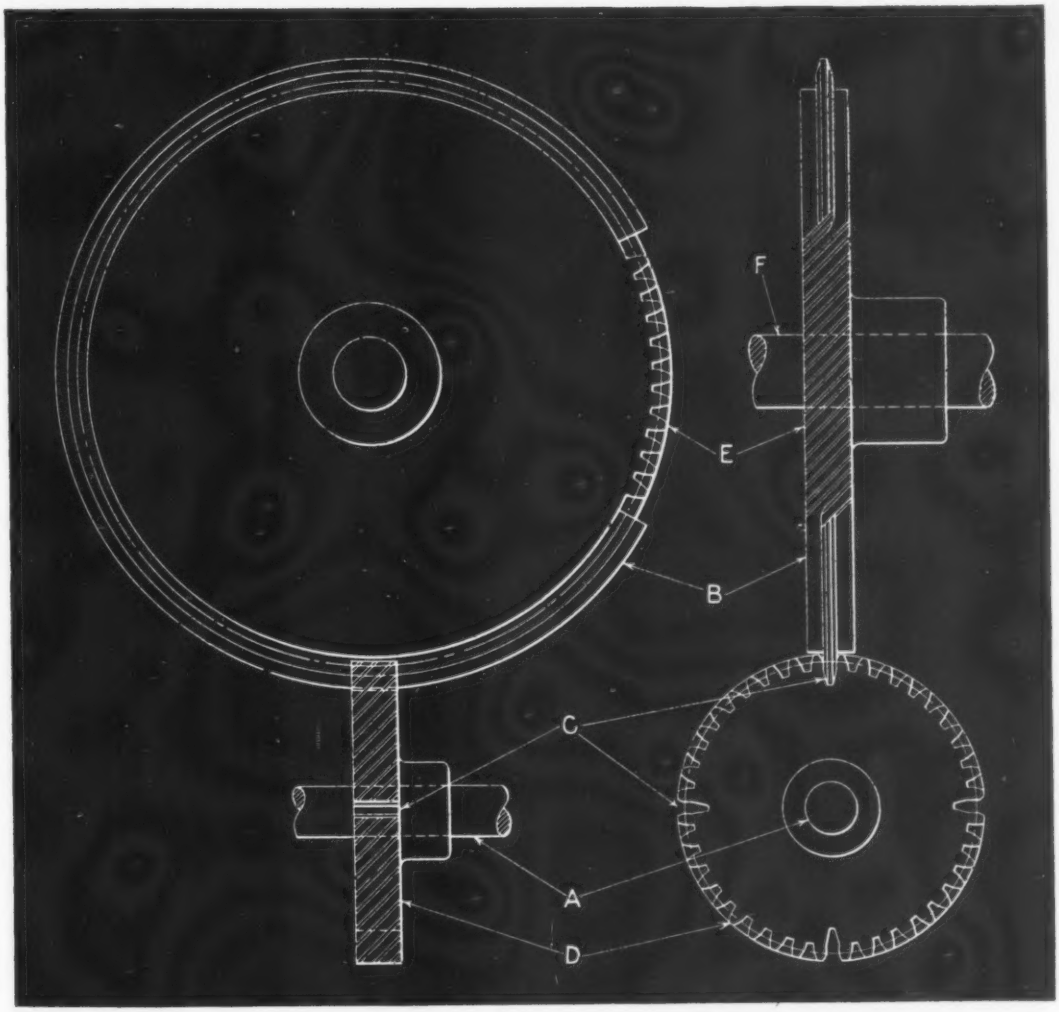


Fig. 1. Modified Helical Gears for Indexing Shaft A One-fourth of a Revolution during One Revolution of Driving Shaft F

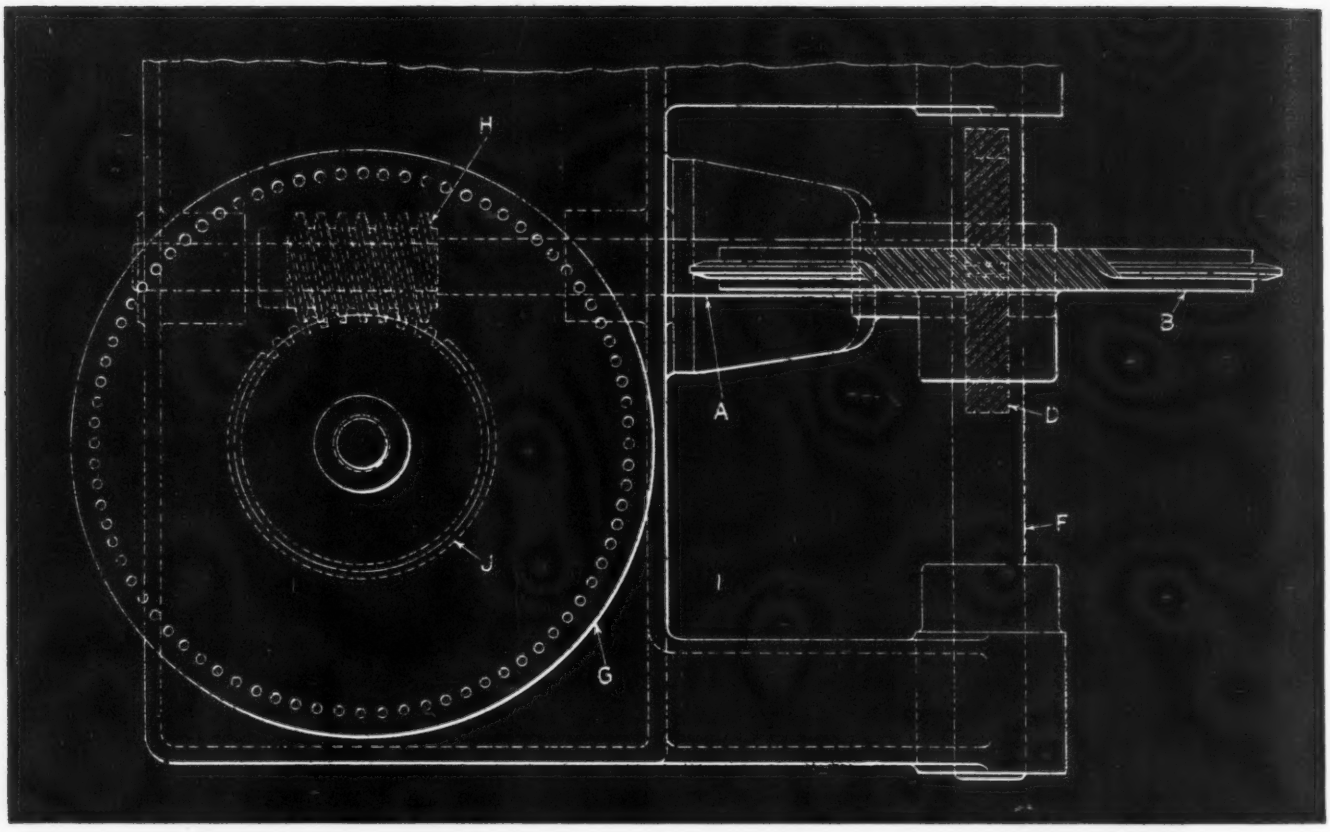
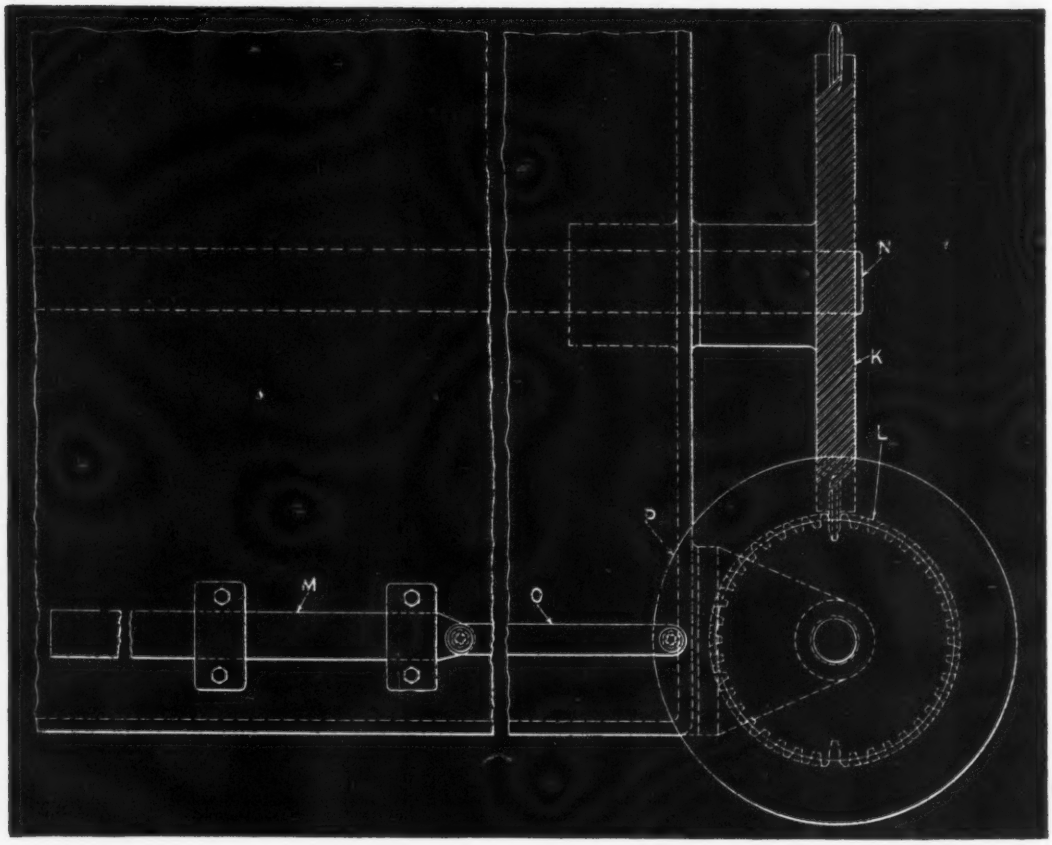


Fig. 2. The Number of Indexings of Plate G per Revolution is Increased by Interposing Worm-gearing between It and the Modified Helical Gears B and D

Fig. 3. Modified Helical Driving Gears N and L Arranged to Produce a Reciprocating Movement of Slide M with a Dwell at Each End of Its Travel



reducing the number of helical teeth *E* in gear *B*. Similarly, shaft *A* can be indexed through a greater arc by decreasing the number of slots *C*. The number of helical teeth *E* in driving gear *B* must equal the number of helical teeth in gear *D* between any two adjacent slots *C*.

The modified helical gears *B* and *D* shown in Fig. 1 can be used as illustrated in Fig. 2 to increase the number of indexing stations without changing the number of revolutions per minute of the driving shaft *F*. This is accomplished by interposing worm-gearing beween shaft *A* and index-plate *G*. The pitch of worm *H* may be so selected that worm-wheel *J* will index plate *G* the required number of divisions. In the case illustrated, a 1 1/2-inch pitch, double-thread worm was used to produce the required indexing.

In the mechanism shown in Fig. 3, modified helical gears *K* and *L* are used to reciprocate a slide *M*. This slide is moved to the right in one revolution of driving shaft *N*, and to the left (to the position shown) in the next revolution of the shaft. The motion of the slide in either direction is accomplished during one-half of a revolution of shaft *N*, the slide dwelling at the end of its travel during the other half revolution of the shaft. Link *O* connects the slide to plate *P*, which is keyed to the shaft on which gear *L* is mounted.

* * *

New Aluminum-Oxide Abrasive Can be Used for Grinding Ball-Bearing Races

In the article "New Aluminum-Oxide Abrasive Improves Grinding Efficiency," published in January MACHINERY, it was stated that 32 Alundum, being available only in 100 grit and coarser, is not applicable for grinding ball bearings. This statement gave an erroneous impression. We are informed by the Norton Co., manufacturer of 32 Alundum, that although this abrasive has not been successfully applied to the grinding of balls for ball bearings, it has been tested out with very satisfactory results for such operations as the grinding of ball-bearing races on centerless, surface, and internal grinding machines.

* * *

Cash awards totaling $114,100 were paid out by the General Electric Co., Schenectady, N. Y., last year to employes for suggestions on improved plant and office operation. Over 8000 suggestions made by the employes for improved production were adopted last year. The highest award of the year was $3000.

Electronic Heating Speeds up Can Production

The use of electronic heating for annealing milk cans at the plant of the Buhl Mfg. Co., Detroit, Mich., has resulted in increased production of cans, reduced manufacturing costs, and a more durable product. Prior to the installation of two 5-kilowatt General Electric electronic heaters for the annealing operation, the entire breast of a milk can had to be annealed in a gas-fired furnace, although only the neck of the can needed to be heated. Then the can had to be pickled to remove the scale.

High-speed Annealing of Milk Cans in a Two-position Electronic Heater

With the new method, it is possible to anneal as little as 1 inch of the can neck, and the piece can be brought up to the annealing temperature in twelve seconds. The heater has two work positions, a can being annealed in one position while a second can is being loaded in the other. At the end of each heating cycle, the power is transferred from one heating position to the other by means of a throw-over switch.

* * *

Every mechanical problem in industry is a frontier.—*Henry Ford II*

Tool Engineering Ideas

Tools and Fixtures of Unusual Design, and Time- and Labor-Saving Methods that Have been Found Useful by Men Engaged in Tool Design and Shop Work

High-Production Nut Tapper Made from Standard Parts

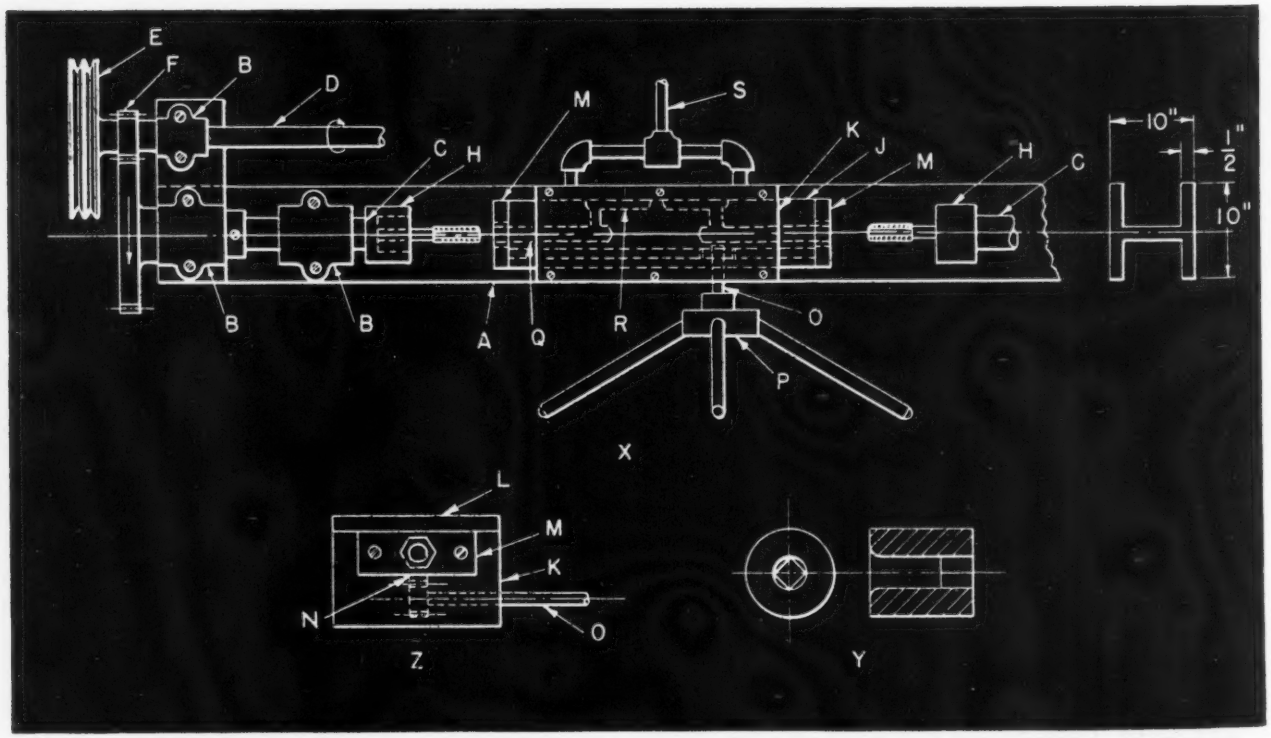
By DONALD A. BAKER

When the delivery date on a contract for thousands of turnbuckles was threatened because of the unavailability of tapped nuts, a special machine was made to tap both left- and right-hand threads at a production rate of three hundred 1 1/2-inch nuts per hour. The operation is semi-automatic, and the construction of the machine is such that it can be modified to tap other types of nuts if the need arises.

The machine, shown at *X* in the accompanying illustration, was assembled from standard parts, such as bearings, gears, pinions, and short taps. The bedplate *A* is a standard heavy-section I-beam in which holes were drilled and tapped for the various parts, including the babbitted pillow blocks *B*. These pillow blocks serve as the bearings for the two main spindles *C* and the drive-shaft *D*.

In order to obtain the correct speed for any size of tap from 5/8 inch to 2 inches, a 5-H.P. variable-speed motor was used as the driving unit. The motor is connected by belt to pulley *E* and drives the spindles through pinion and gear *F* and another gear train (not shown in the illustration) at the opposite end of the bedplate. Shaft *D* also drives a small geared pump that circulates cutting oil to the taps when they are in operation.

All bearings were scraped to insure a close fit with the ground and polished spindle shafting. The tap chucks, shown in the detail view at *Y*, were chamfered so that the tap could be inserted quickly and easily, and were fitted into bored



Special Machine for Tapping Left- and Right-hand Nuts. A Sectional View of the Tap Chuck is Shown at Y. At Z is Shown the Method of Actuating Ram that Feeds the Blanks to the Tap

holes in the nose-pieces *H*, which were welded to the ends of the spindles.

With the taps chucked to an anchored spindle, it was necessary to design a ram that would feed the nut blanks to the taps. This feeding action is accomplished by the steel ram *J*, which slides in casting *K* and is held in place by a cover plate *L*. The ram is actuated by a pinion that meshes with rack *N* and is turned by shaft *O* through handwheel *P*.

One of the most interesting features of the machine is the method for supplying cutting oil to the taps. Two holes *Q* connect with channels *R* milled in the side of the ram. By studying the action of the ram, it can be seen that when one channel is under the oil-line *S*, the other is blocked off by the cover plate; thus, the action of the ram with respect to the oil supply is similar to the action of a piston in a steam locomotive. With this arrangement, oil is fed to the tap only during the time it actually is cutting, and is automatically fed to the opposite nut when the threading operation has been completed.

On the particular job for which the machine was constructed, a right-hand tap was placed in the chuck in the left-hand spindle and a left-hand tap in the chuck in the right-hand spindle. However, by a proper arrangement of idler gears, the machine can be modified to produce either all right-hand or all left-hand nuts, as desired.

With a blank in place, the chuck is advanced to the tap. From then on, the machine operates automatically. While the tapping is being done on a nut in one chuck, the opposite chuck is loaded. When the nut has been threaded, the ram is fed to the other tap and the second nut is engaged. This movement pulls the threaded nut and its tap from the chuck; they are then separated, the nut being put into a wire net that permits the oil to drain off, and the tap being put back into its chuck. Although many taps were worn out on this job, only a few broke in service.

Compound Die for Blanking and Forming Part with Curled Edge

By JOHN E. HALLBERG

Ribbed, curled-edge ash trays, such as shown in Fig. 1, are blanked and completely formed from a strip of aluminum, 4 1/8 inches wide by 0.012 inch thick, in one operation by the compound die shown in Fig. 2. The material is fed through the die continuously, from left to right, and the formed ash trays are ejected by compressed air. A production of sixty pieces per minute is obtained with this die on a 10-ton, double-acting punch press. The parts are formed to a depth of 1/4 inch and are provided with six ribs and a curled edge 0.072 inch in diameter.

The die set *M*, Fig. 2, has two guide posts *G* for holding the upper and lower members in alignment. In operation, as the press ram descends, punch *A* and die *B*, blank a 4-inch diameter disk from the strip stock. Die *B* is supported on four 3/4-inch diameter pressure pins *F*, which exert a total upward pressure of 5 tons. Of this pressure, only 3 1/2 tons is required for blanking. In the blanking position, a close-up view of which is shown to the left in Fig. 3, the disk to be formed is held between the combination curling die and upper pressure pad *O* and the blanking die *B*, to prevent wrinkling of the metal when the forming operation begins. The strip stock is held between the blanking punch *A* and the lower pressure pad *P*. The height of the lower pressure pad is controlled by the stripper bolts *E*, Fig. 2. Eight springs *H*, which fit into the under side of the lower pressure pad, have a tension of 45 pounds when compressed, and 13 1/2 pounds when ready to strip the material from the die.

Upon the completion of the blanking operation, forming punch *C* descends, drawing the disk

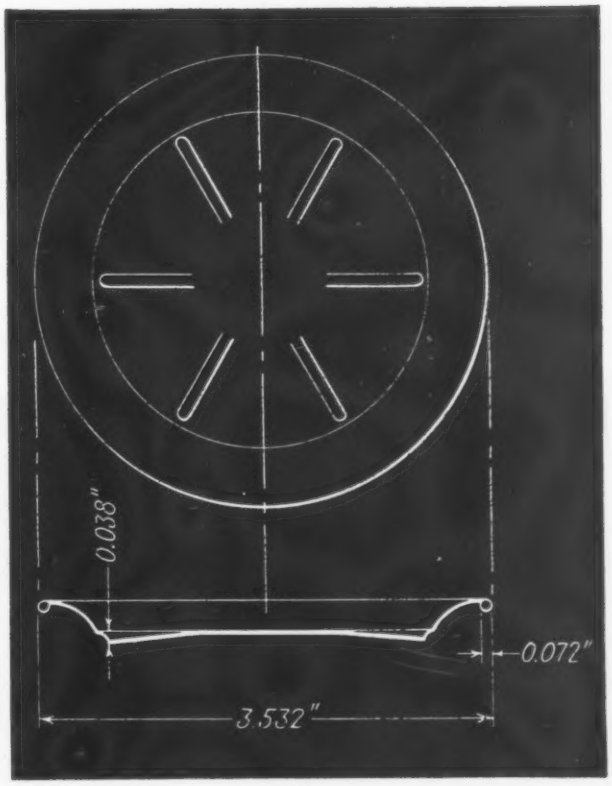


Fig. 1. Rib-reinforced, Curled-edge Ash Tray, which is Blanked and Formed in One Operation by the Compound Die Shown in Fig. 2

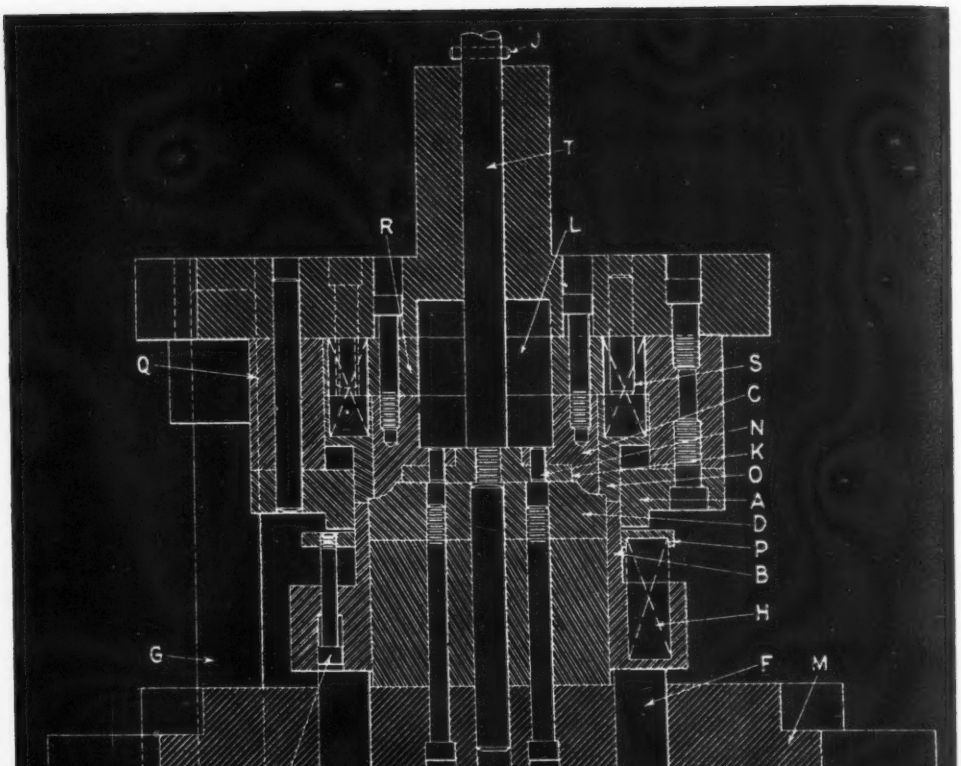


Fig. 2. Cross-section of Compound Die, Showing Relative Positions of Die Components at End of Ram Stroke, when Part has been Completely Formed

from between pressure pad *O* and blanking die *B* and shaping it in the hardened and ground tool-steel forming die *D*, as shown in the two center views of Fig. 3. The forming punch is actuated by a spring at *L*, Fig. 2, which exerts a pressure of 2100 pounds on the punch.

Curling die *O* then moves down and forms the curl on the periphery of the work, as shown at the right in Fig. 3. The curling die is actuated by springs *S*, which exert a pressure of 45 pounds on it when the springs are compressed.

The bottom face of the knock-out pad *K* is provided with six radial ridges which form the reinforcing ribs in the part. This knock-out pad, which only travels 3/16 inch, is a sliding fit on dowel-pin *N*. The dowel-pin is pressed into the forming punch *C*, and the knock-out pad is threaded on pin *T*. Pin *J*, which is pressed through the upper portion of pin *T*, controls the travel of the knock-out pin and pad.

Spacer *Q*, which is placed between the blanking punch *A* and the upper punch-holder, and spacer *R*, which is placed between both the forming punch and curling die and the punch-holder, are of machine steel. This use of spacers reduces punch and die height, and thus effects a saving in hardened and ground tool steel.

* * *

The transit industry of the United States and Canada expects to spend over half a billion dollars in 1947 on new equipment and on modernizing and rebuilding older vehicles.

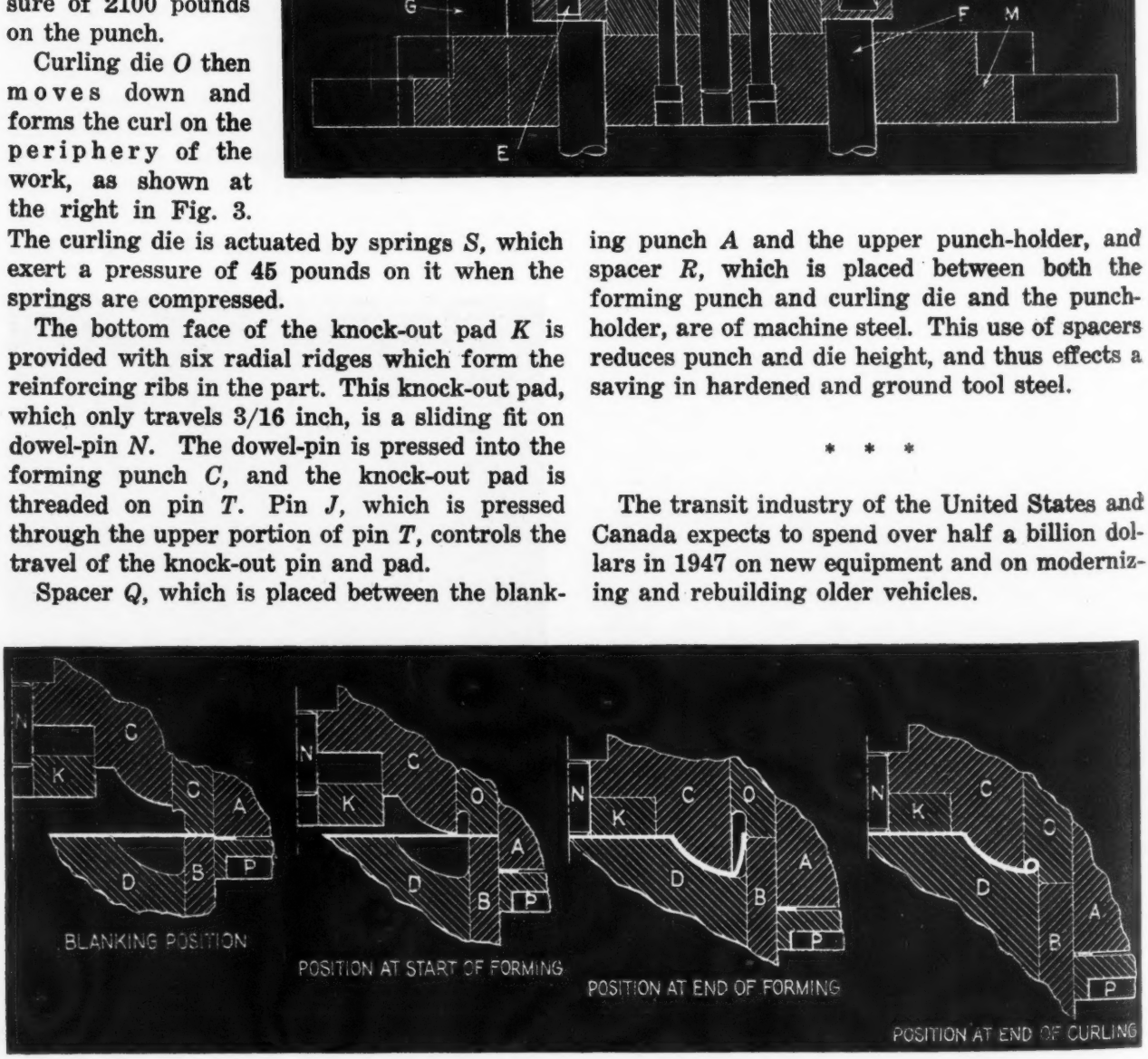


Fig. 3. Close-up Views, Showing the Blanking, Forming, and Curling Positions of Compound Die

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Hardinge Multi-Operation Chucking Machine

Hardinge Brothers, Inc., Elmira, N. Y., have just announced a new precision multi-operation chucking machine designed for turning, boring, and threading parts up to 6 inches in diameter which have been roughed out on automatic screw machines or turret lathes. This machine is also adapted for finishing stampings, castings, forgings, and other kinds of work that ordinarily require many individual set-ups. The new machine, shown in Fig. 1, is specifically designed to fill the gap existing between the second-operation machine, previously brought out by the company for handling small, accurate work, and large turret lathes.

Typical examples of work performed on the new machine include the finishing of a wide variety of parts requiring the cutting of threads that must be concentric with turned or bored diameters, as well as square and true with shoulders on the work. Parts requiring many bored and turned diameters that must be concentric and have a fine finish can also be produced on a rapid-production basis.

The turret and the production threading head use standard tools, thus making simple, low-cost set-ups possible, an important advantage in handling short-run jobs. The eight-position turret increases the range of tooling possibilities, and the separate threading unit is practically the equivalent of an additional turret position. The headstock equipped with a pre-loaded ball-bearing spindle has been arranged to afford maximum rigidity, and when combined with the power-driven carriage, is especially well adapted for precision boring operations.

The headstock spindle of the new machine has a speed range of 150 to 3000 R.P.M. in either the forward or reverse direction. The spindle takes standard 5C collets, providing a 1-inch round collet capacity through the spindle. Step chucks provide collet-like chucking of work up to 6 inches in diameter. Odd-shaped castings, stampings, and forgings can be held in two-, three-, or four-jaw chucks.

The production threading head is controlled by a precision master lead-screw mounted directly on the rear of the headstock spindle. Since there are no intervening gears, accurate duplication of the lead-screw accuracy is assured. Threading is done at speeds usually associated only with turning operations. For example, a speed of 500 R.P.M. is used for cutting 1 1/2—20 threads in steel. A 3-inch diameter 24-pitch thread is cut in an aluminum die-casting at 1500 R.P.M. It is unnecessary to cut a thread relief groove in the work, as the thread length control automatically lifts the threading tool from the work at the end of the cut. With this arrangement, threads can be cut within one-half turn from a shoulder.

The bed has hardened and precision-ground steel dovetail ways

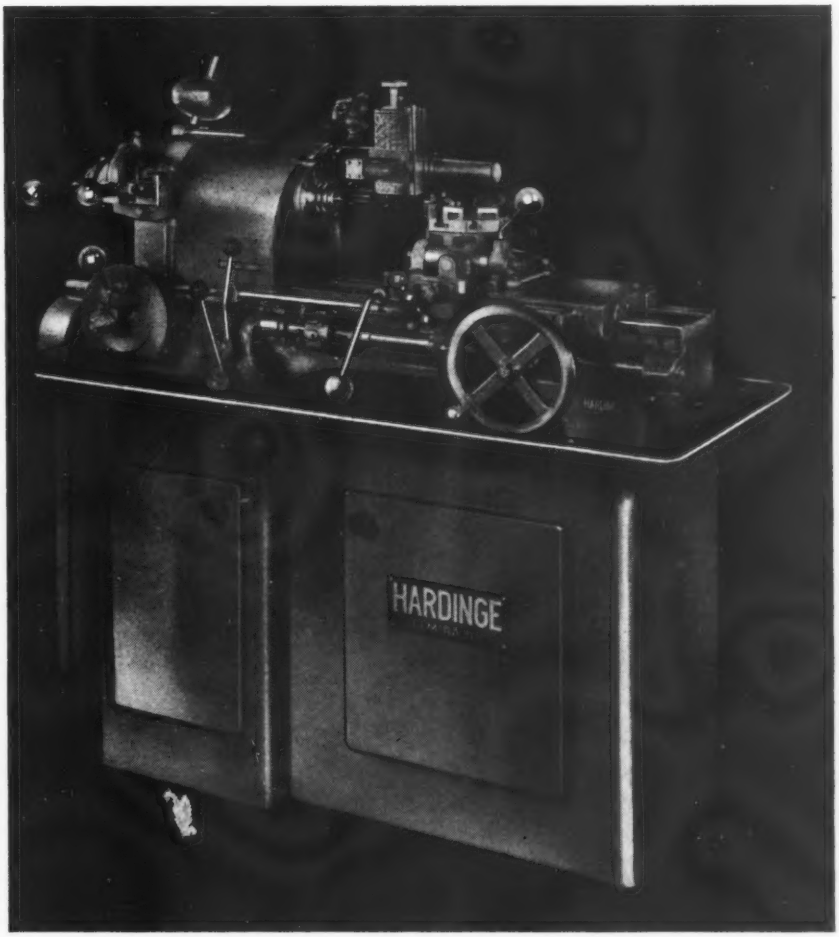


Fig. 1. Hardinge Precision Multi-operation Chucking Machine

To obtain additional information on equipment described on this page, see lower part of page 226.

of the same design as those used on Hardinge precision tool-room lathes and second-operation machines. With this design, the forces resulting from the work cutting load apply a holding-down action, which serves to eliminate chatter and vibration.

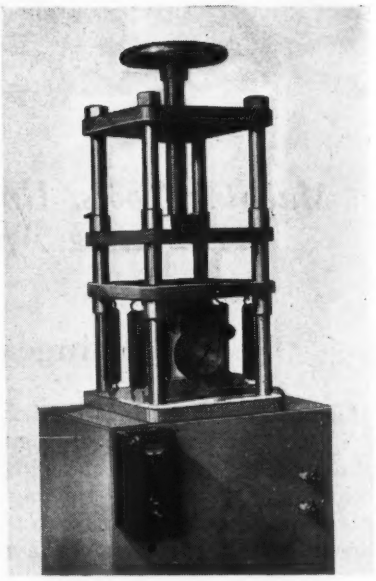
The carriage of the machine is of generous proportions, yet it is sufficiently sensitive to facilitate machining to precision tolerances. Its built-in cross-feed turret permits work to be bored, turned, and faced by tools of extremely short lengths, since the turret faces can be brought close to the work. The cross-feeding of the turret can be accomplished either by a feed-screw or a lever feed. Any one of the eight turret stations can be adjusted without affecting the others. The adjustable turret station feature permits final adjustment of the cutting tools for size without resorting to "hammer-adjustment." The turret accommodates standard 3/8-inch square tool bits or 3/8- by 3/4-inch rectangular tools, mounted directly on its hardened and ground steel top surface. Through the use of single, double, and triple tool-holders, as many as twenty-four single-point tools can be employed in one set-up.

The machine is supplied with a welded pedestal, which has a motor compartment in the left-hand side and a tool storage compartment in the right-hand side. The coolant facilities are an integral part of the pedestal base, the coolant pump being individually motorized.....61

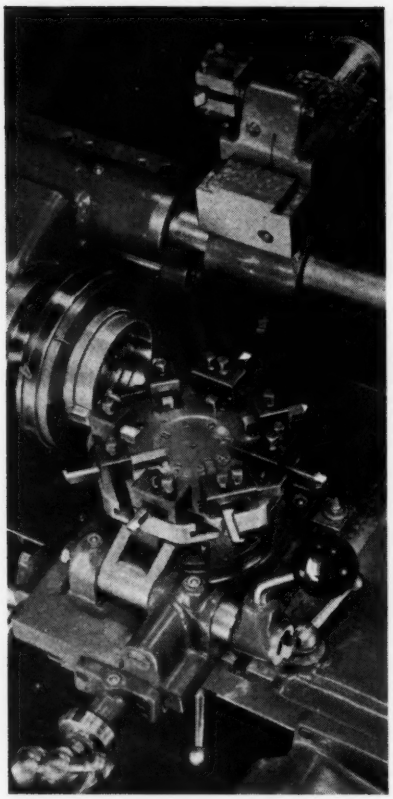
Wroble "Super Hi-Speed" Hydraulic Presses

The Wroble Engineering Co., 1067 Davis Terrace, Schenectady 3, N. Y., has brought out a "Super Hi-Speed" press designed for production and general-purpose use. This press is adapted for punching, blanking and deep-drawing of metal parts. It can also be used for laminating plastics, and general-purpose compression molding of plastics. It is capable of operating at a speed of over fifty strokes per minute. Rugged four-rod construction with structural steel platens are employed.

The easily adjustable relief valve controls the operating pressure, and a control valve is provided for regulating the ram speed. The press can be arranged to operate in periodic cycles or it can be manually controlled for single-cycle operation. For high-speed operation, a multiple pump system is used. Presses operated by an electric motor utilize a large-volume pump and a high-



Wroble Hydraulic Press Designed for High-speed Operation



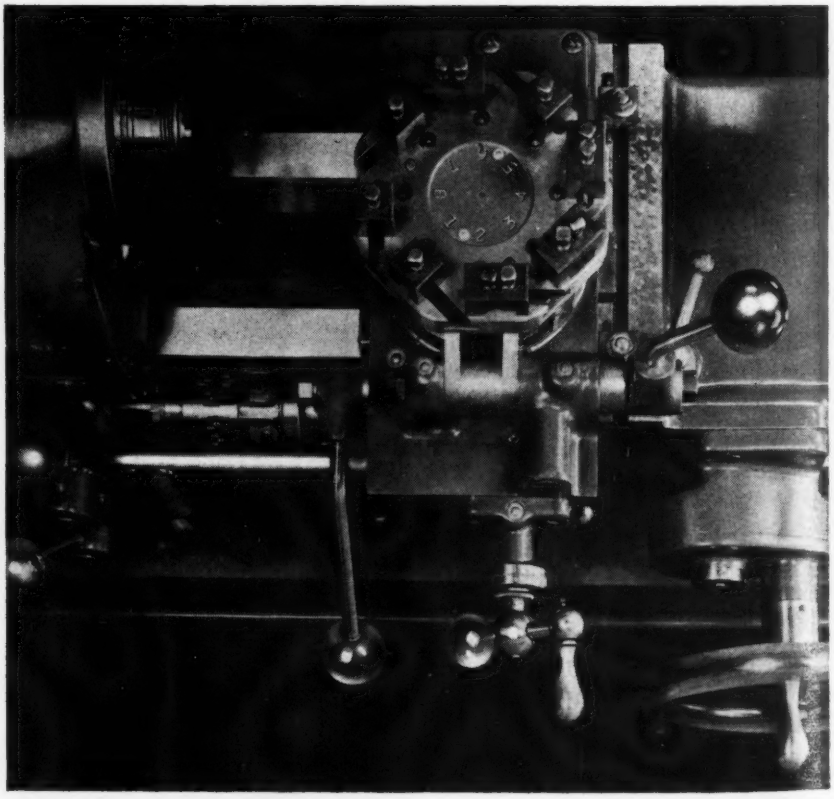


Fig. 2. (Left) Machine Shown in Fig. 1 Equipped for Turning and Threading Part to Close Tolerances.
Fig. 3. (Right) Close-up View of Eight-position Cross-sliding Carriage Type Turret of Hardinge Precision Multi-operation Chucking Machine

To obtain additional information on equipment described on this page, see lower part of page 226.

pressure radial piston pump coupled to a 3-H.P. motor. The oil reservoir capacity is 5 gallons. The press can be supplied in upward moving platen type only. It is made in capacities of 25, 35, and 50 tons, ranging in weight from 800 to 2000 pounds.....62

Plastic Injection Molding Machine

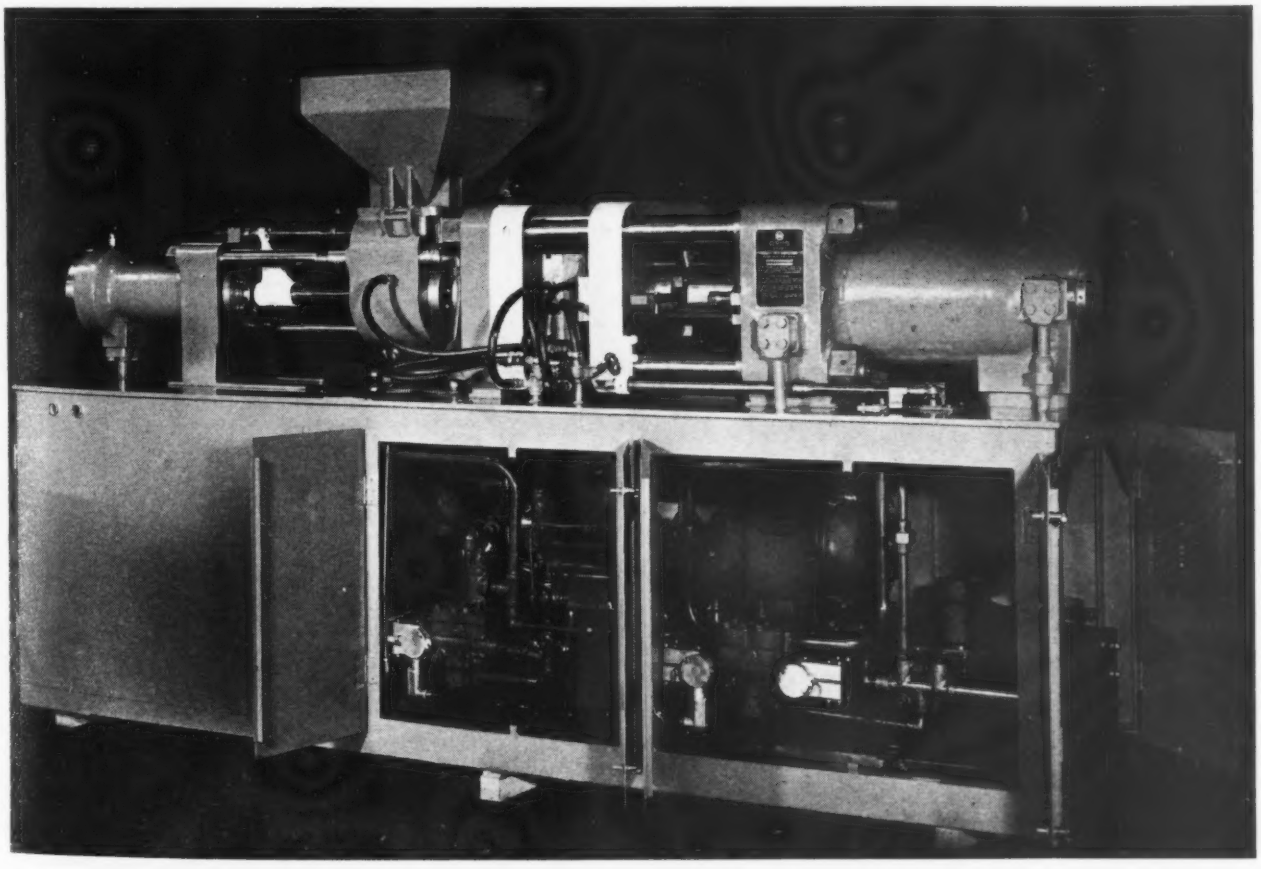
A new all-hydraulic plastic injection molding machine of 4-ounce capacity has been announced by the Hydraulic Press Mfg. Co., Mount Gilead, Ohio. Although of simplified construction, this machine is more powerful and faster acting than its predecessor. The self-contained hydraulic power system comprises a single gear pump, working in conjunction with a newly designed "Hydro-Power" pressure booster, both being driven by a direct-connected 15-H.P. motor. The hydraulic system unit, mounted in the machine base, is designed to provide quiet operation with a mininum number of moving parts at a working pressure of 2250 pounds per square inch.

The new light-weight gravity feed system, with a 50-pound capacity sheet-steel hopper, is hinged at its base to provide access to the feed chamber and to facilitate cleaning. Sprues and gates from moldings can be fed directly into the chamber through an opening adjacent to the plunger. The feed mechanism is self-compensating, automatically providing the correct amount of material.

Higher mold clamping capacities, an internal booster ram which provides for rapid mold closing, and a double-acting ram which supplies live hydraulic pressure up to 125 tons for sealing the mold are features of this machine. The position of the automatic shift-over of pressure from the booster ram to the main ram is adjusted by rotating a nut at the end of the cylinder. This provides for automatically slowing down the mold clamp ram at a predetermined position, and results in the elimination of die "slam."

The clamping speed has been substantially increased, the clamp ram being closed at the rate of 530 inches per minute and opened at the rate of 355 inches per minute. The forward travel of the mold clamp is limited by a hydraulic by-pass arrangement which eliminates the need for stop-collars on the tie-rods. The opening speed of the injection ram has been increased to 475 inches per minute, and the larger plunger has an injection capacity of 527 cubic inches of material per minute, delivered at a pressure of 20,000 pounds per square inch.

The movable die-head consists of a solid steel plate which can be advanced by two hydraulic cylinders for easy access to the heating chamber. This arrangement also permits material to be injected into the atmosphere without entering the mold. The stationary head is U-shaped, and permits easy removal of the heating chamber. A 3-kilowatt multiple zone heating system is provided for the injection chamber. Mounting the molds vertically between tie-rods and utilizing the full vertical platen dimensions permits the use of molds up to 15 1/2 by 21 inches, while horizontal mounting provides for maximum mold dimensions of 12 by 24 1/2 inches. 63



Hydraulic Injection Molding Press Built by the Hydraulic Press Mfg. Co.

To obtain additional information on equipment described on this page, see lower part of page 226.

Walker Improved Vertical-Stroke Surface Grinder

Several important improvements have been made in the vertical-stroke surface grinder manufactured by the O. S. Walker Co., Inc., Worcester 6, Mass. The spindle of the improved machine is raised and lowered either hydraulically or by air, and then fed hydraulically at any desired rate. Provision is made for a wide range of movements, which are obtainable through the control valve operated by a sliding cam arrangement that can be set for any desired stroke. The hydraulic equipment can be operated either by a foot- or a hand-actuated control valve.

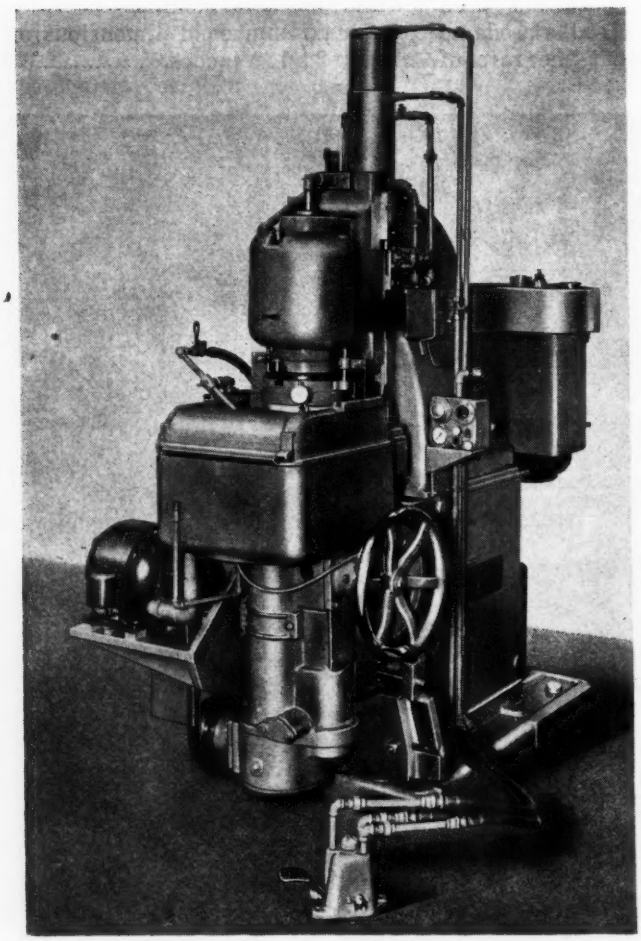
The machine is driven by a 10-H.P. motor, and if desired, the spindle can be motorized. The 12-inch magnetic-chuck work-table can be tilted 2 degrees inward and 5 degrees outward for concave grinding, and 15 degrees for bevel grinding operations. This permits knives to be ground to a bevel up to 15 degrees. The work-table is driven by a separate motor through V-belts, various changes of speeds being obtained by means of interchangeable pulleys. The machine utilizes an 8-inch cup-wheel operating at a speed of 2000 R.P.M. It requires a floor space of 37 by 68 inches, and weighs approximately 5000 pounds. 64

Reed-Prentice Vertical Milling Machine with Adjustable Ram

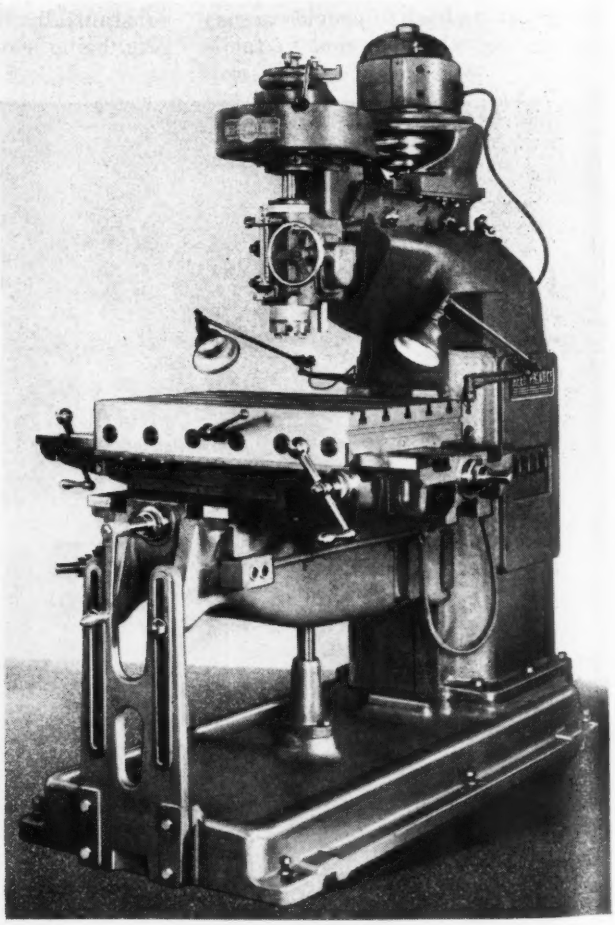
A heavy-duty vertical milling machine with an adjustable ram designed for high-speed milling, routing, and die-sinking has just been brought out by the Reed-Prentice Corporation, Worcester 4, Mass. The wide operating range, versatility, and rugged construction of this machine make it suitable for work on plastic and rubber molds, die-casting dies, and forging dies, work as large as tire molds being within its capacity.

The milling head is mounted on a horizontal ram, which provides a wide range of forward and backward travel. The V-belt drive is designed to assure smooth, chatterless operation for die-sinking work at high or low speeds. The spindle is supported at the top by precision ball bearings, and at the bottom by precision double-row roller bearings. Extreme rigidity of the head and spindle construction makes it possible to use large-diameter or two-lip cutters. Roller bearings assure easy movement of the table and saddle.

Power is furnished by a 3-H.P., 1200-R.P.M., 60-cycle motor or a 3-H.P., 1000-R.P.M., 50-cycle motor mounted on the ram. The drive to the spindle is by a belt direct from motor to spindle. Both pulleys have four steps, and the spindle pulley is equipped with back-gears. Ten speeds can be



Improved Vertical-stroke Surface Grinder Brought out by the O. S. Walker Co.



Reed-Prentice Vertical Milling Machine with Head Mounted on Horizontal Ram

To obtain additional information on equipment described on this page, see lower part of page 226.

obtained with the open belt, ranging from 400 to 2600 R.P.M., and five speeds ranging from 133 to 320 R.P.M., through back-gears.

The spindle has a positive key drive for cutters and arbors, and is designed to eliminate torsional deflection. Vertical movement of the spindle is obtained through a quill having a long bearing in the head. The machine has a longitudinal feed of 27 inches and a cross-feed of 20 inches. The knee has a vertical adjustment of 16 inches, and the ram a horizontal adjustment of 16 inches. The table is 32 inches long, 22 inches wide, and 4 inches thick. The spindle has a vertical travel of 5 inches, and is furnished with an NMTBA No. 40 taper hole.

The machine requires a floor space of 100 by 60 inches, has a height of 90 inches, and a shipping weight of 6500 pounds. Attachments available at extra cost include power feed, motor-driven pump, hand or power feed rotary table, universal angle-plate, verniers, vise, and index centers...65

Cleveland Double-Action Toggle Press

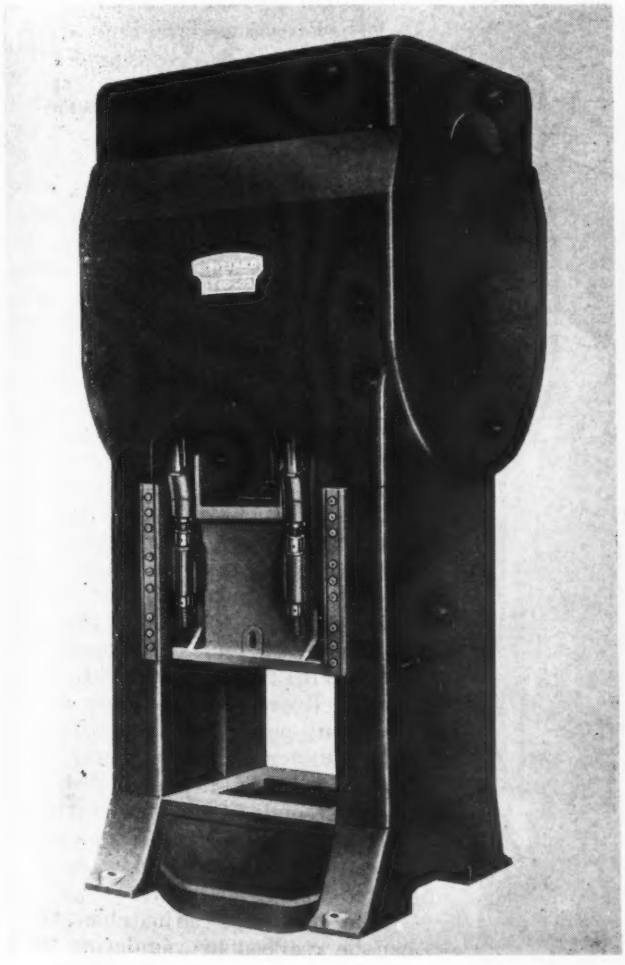
A double-action toggle press of improved streamline design, with all gears enclosed in the box type crown together with the drive unit, is a recent product of the Cleveland Punch & Shear Works Co., Cleveland 14, Ohio. This press is equipped with an electrically controlled air-operated friction clutch. The top cover is so designed that it can be easily removed.

The machine illustrated has a 28-inch stroke, 6-inch adjustment, an inner slide capacity of 500 tons, and an outer slide capacity of 300 tons. This type of press can, however, be furnished in sizes and capacities to suit requirements, and with a single connection or with two connections. 66

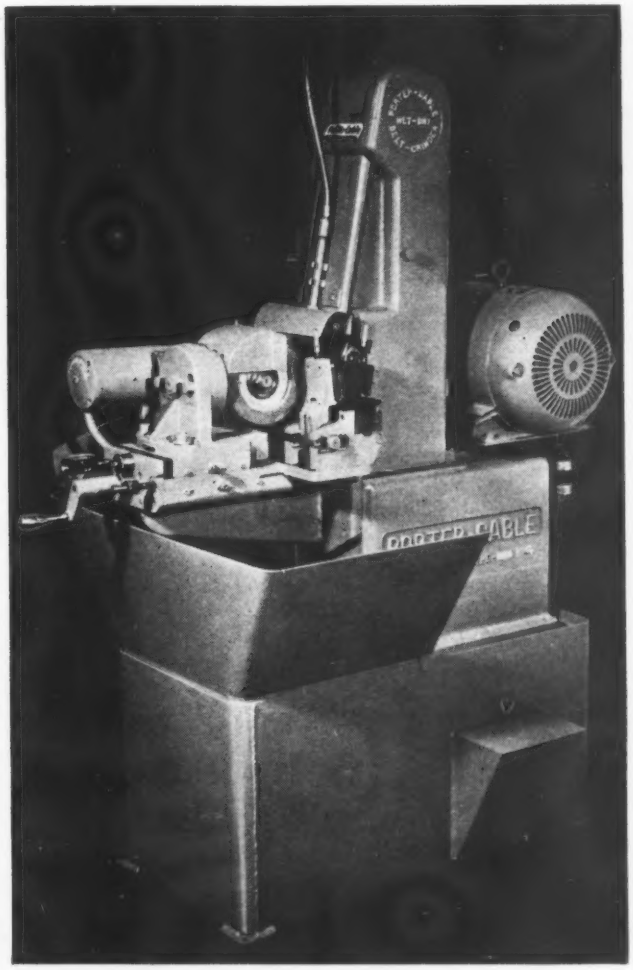
Porter-Cable Centerless Wet-Belt Grinder

A centerless wet-belt grinder is the latest addition to the line of wet-belt machines manufactured by the Porter-Cable Machine Co., 1801-3 N. Salina St., Syracuse 8, N. Y. This grinder has an endless abrasive belt which operates over a resilient contact roll, the abrasive belt and the contact roll being balanced to cut uniformly. The work is done by the abrasive belt, the contact roll being subjected to little if any wear. This roll backs up the abrasive belt, and therefore remains flat and square at the corners. Its diameter also remains constant, a condition that eliminates much truing and balancing. The changing of abrasive belts can be accomplished as easily and quickly as on any abrasive-belt machine.

Since the grinding unit maintains a balanced condition and the contact roll remains flat and square, setting up is so simplified



Double-action Press Brought out by the Cleveland Punch & Shear Works Co.



Centerless Wet-belt Grinding Machine Built by the Porter-Cable Machine Co.

To obtain additional information on equipment described on this page, see lower part of page 226.

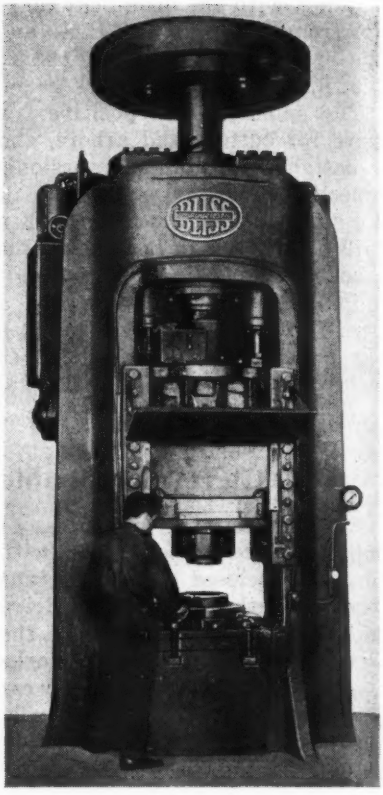
that it can be done by the less experienced men. A swivel head is provided so that the contact roll can be trued up on the machine itself while in its normal position, although truing is seldom necessary. The resiliency of the contact roll serves to eliminate chatter. The soft roll follows or conforms to the shape of the part being ground and serves to clean up irregular stock. A semi-hard roll is recommended for accurate grinding.

This new centerless grinder is adapted for handling "through" work on short pieces, ranging from 3/4 inch to 2 feet in length. Work pieces ranging from 3/32 inch to 2 1/4 inches in diameter can be readily handled on the machine. 67

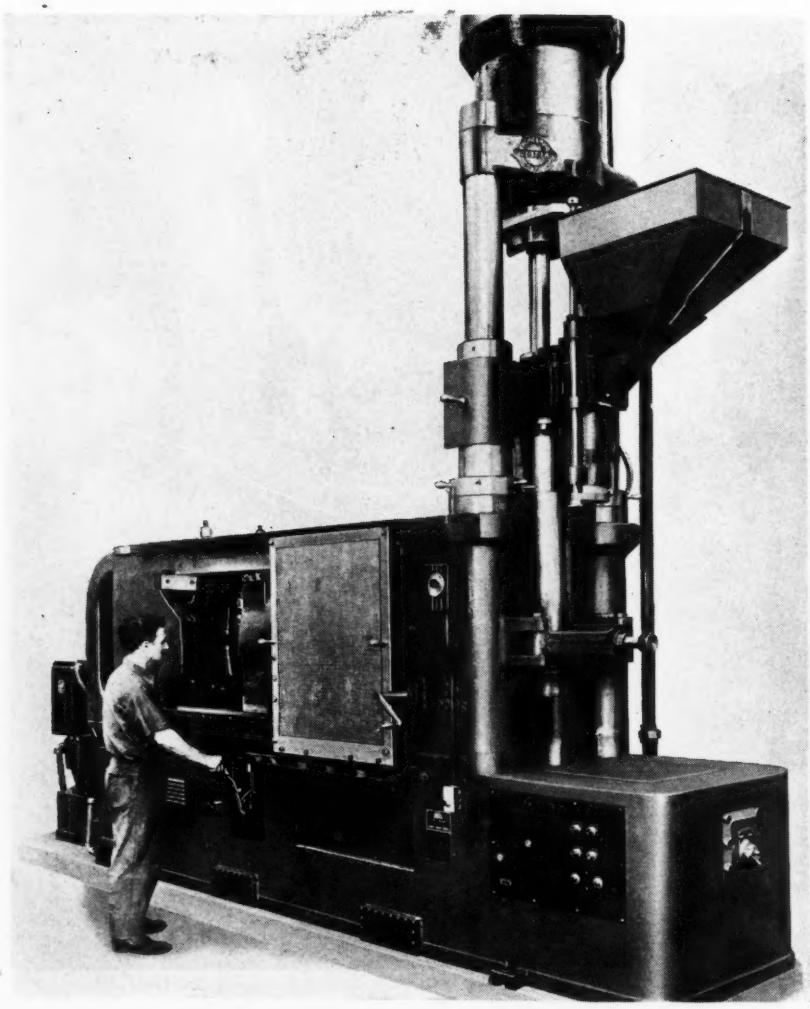
Giant Injection Molding Machine

Injection molding machines capable of molding plastic pieces weighing up to 32 ounces over a projected area of 150 square inches are now being made by Lester-Phoenix, Inc., Cleveland, Ohio. These huge machines are the largest models of the Lester line announced to the trade in 1945. The injection pressure at the end of the plunger stroke on the new machines is 27,000 pounds per square inch, but the makers claim that even this high pressure is easily held in check by a normal mold locking pressure of 600 tons.

The one-piece cast-steel frame of this press has a cross-sectional area of 240 square inches. The platens are 29 1/2 by 40 inches in size, and the maximum space between them is 30 inches. The vertical injection cylinder; die-height adjusting screw; automatic ejection; and separate control of both injection speed and pressure are features of the new line of machines. 68



Bliss 600-ton Hydro-screw Percussion Type Press



Lester-Phoenix Giant Size Molding Machine

Bliss Percussion Type Press

A radical departure from conventional percussion press design, in which hydraulic pressure is employed for traversing the slide, has been incorporated in a new percussion press developed by the E. W. Bliss Co., Detroit 2, Mich. This new press is said to make possible rapid, economical production of hot steel, brass, and aluminum forgings in a wide range of shapes. It makes use of a flywheel mounted at the top of the screw, which is brought up to speed by hydraulic pressure. The energy thus developed and accumulated in the flywheel is utilized to deliver a quick hammer-like blow. With this arrangement, each blow delivered by the press is of uniform power. On a 16-inch stroke under maximum power, the machine cycle is completed in three seconds, from the starting to the return position. In many cases, only a single blow is required to finish a part.

The power is adjustable, and can be reduced by regulating the volume of the variable-delivery pumps. Continuous lubrication of the screw is maintained by means

To obtain additional information on equipment described on this page, see lower part of page 226.

of a pump in the slide which provides a constant supply of oil at the top of the nut while the press is in operation.

The quick-action valves reverse the motion of the hydraulic pistons to obtain immediate reversal at the rebound point. At the top position, the valves immediately lock the hydraulic pressure, thus preventing the slide or gate from drifting downward. A push-button control with selector switch is provided for setting the dies. Provisions for "inching" make it possible to adjust the slide up or down in small increments to facilitate quick, accurate setting without danger of injury to the dies.

An air-operated lift-out arrangement in the bed and a similar knock-out in the slide are controlled by limit switches operated by the slide. The press is constructed of cast steel and is self-contained. It is quiet in operation, and does not require a skilled operator.

The slide area is 25 by 27 inches, and the bed area 26 by 29 inches. The press is equipped with one 40-H.P., 1200-R.P.M. motor and two Vickers pumps, and has a 12-inch lead, four-thread screw, 11 inches in diameter. The flywheel is operated at a speed of 115 R.P.M. and develops a kinetic energy of 21,000 foot-pounds. This type of press is now available in three regular sizes—400-, 600-, and 1000-ton capacities. 69

Cincinnati Plain and Universal Milling Machines

The Cincinnati Milling Machine Co., Cincinnati 9, Ohio, has recently added to its line of knee-and-column type milling machines a new model designated the No. 2ML. This machine is made in plain and universal styles as a companion machine to the No. 2MI announced in August, 1946, MACHINERY, page 201. The new model is driven by a 3-H.P. motor, and is about 1000 pounds lighter than the previous machine. In appearance, it corresponds very closely to the No. 2MI, the general features being identical.

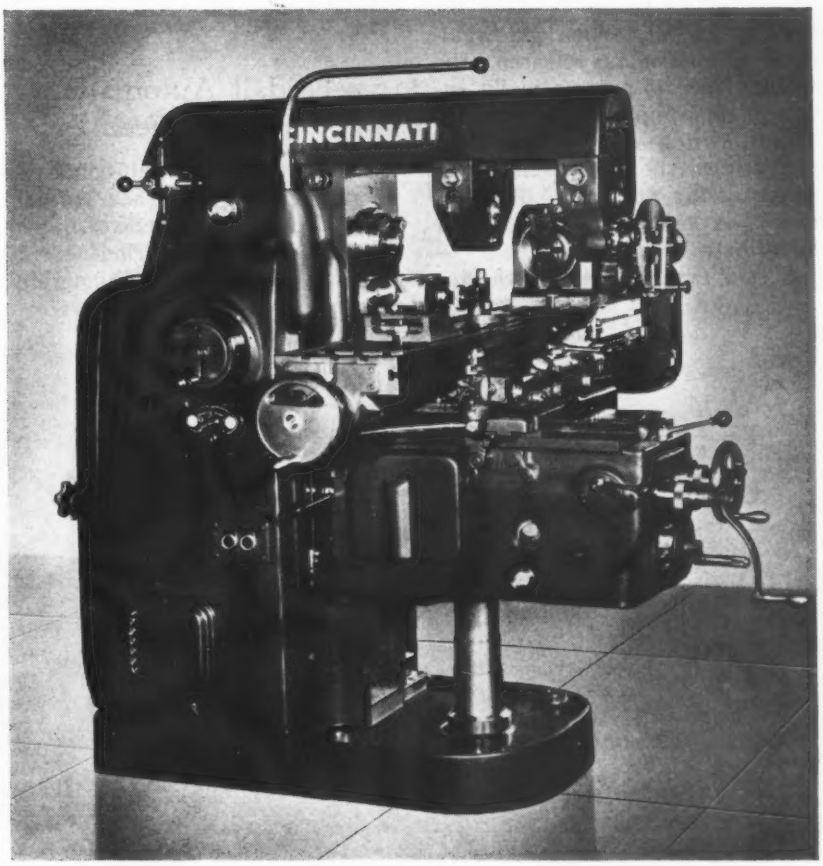
The new machine has the same exceptionally wide feed and speed ratios—60 to 1 and 120 to 1, respectively—covering the requirements for all types of milling operations. There are sixteen spindle speeds, ranging from 25 to 1500 R.P.M., which are changed by means of a single crank type control at the side of the column. Feed rates are changed in the same manner as the speeds, one-half turn of a single crank type control covering the complete range of sixteen feeds, from 1/4 inch to 30 inches per minute.

The motor is mounted on a cradle type support which can be taken from the machine as a unit by removing four bolts. This construction also serves as a convenient and quick means for adjusting the belt. Automatic lubrication of these machines is employed to insure long life and sustained accuracy. The vertical feed-screw is provided with its own lubricating system, and the table ways and parts within the saddle and housing are lubricated by a manual pressure or "oil-shot" system built into the saddle.

Feed controls are independent of each other, and each feed-lever has a forward, neutral, and reverse position. Cross and vertical hand-cranks are automatically disconnected when their respective power-feed levers are engaged.

Rapid traverse at the rate of 150 inches per minute for the longitudinal and cross movements and a vertical traverse movement at the rate of 75 inches per minute can be engaged through a lever control at the side of the machine knee. Electrical controls are built in for protection against dust, coolant, and damage from other causes. If the operator forgets to shut off the current before opening the motor compartment door, the button automatically breaks the circuit, immediately stopping the motor. "Start-stop" push-buttons are built in the column on the left-hand side of the machine.

The main drive clutch, brake, and all spindle drive gearing up to the gear-shaft is contained in a unit bolted to the rear wall of the column, and the entire spindle drive is anti-friction mounted. Many attachments are available, including circular milling tables, several types of vertical and universal spindle attachments, and a motorized over-arm. 70



Cincinnati Universal Milling Machine

To obtain additional information on equipment described on this page, see lower part of page 226.

Davis & Thompson Two-Way Boring Machine

The Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis., has announced the development of a two-way boring machine designed for boring large holes to accurate dimensions and in accurate alignment at a high production rate. This machine will bore a hole 14 3/4 inches in diameter and 12 inches deep from one side of the work, and a hole 9 inches in diameter and 12 inches deep from the opposite side. The work on which these operations are performed consists of air cylinders for railroad locomotives. The machine is equipped with an indexing table on which the work-holding fixture is mounted, and indexed for boring the two pairs of large and small holes in each part in accurate alignment. The production rate is two parts, or eight bores, per hour.

The cycle of operations provides for rapid traverse to the work. A telescoping gage is used to predetermine the length of the bore, the reading being transferred to gages and limit switches to insure feeding to the proper depth. The machine is operated by actuating the rapid-traverse button to advance the tool to the position for starting the cut. When the rapid-traverse button is released, the machine feed is automatically engaged. On completion of the cut, a limit switch reverses the feed and returns the boring heads to their starting positions. This sequence of operations is carried out by both heads.

A lever arrangement on the indexing table raises the table 0.010 inch off the ways, transferring the weight of the table to ball bearings, so that it can be easily indexed. The indexing pin is manually withdrawn and the table manually indexed 180 degrees, and then locked in position. An individual drive is provided for each head, consisting of a 15-H.P. variable-speed direct-current motor, V-belts, change-gears, and a gear train. A speed range of 330 to 1000 R.P.M. is obtained by varying the motor speed and driving directly through the V-belts to the spindle. Disengaging the clutch serves to disconnect the motor-driven sheave. The drive to the spindle is then obtained through the change-gears and gear train. With this arrangement, the speed range is 60 to 300 R.P.M.

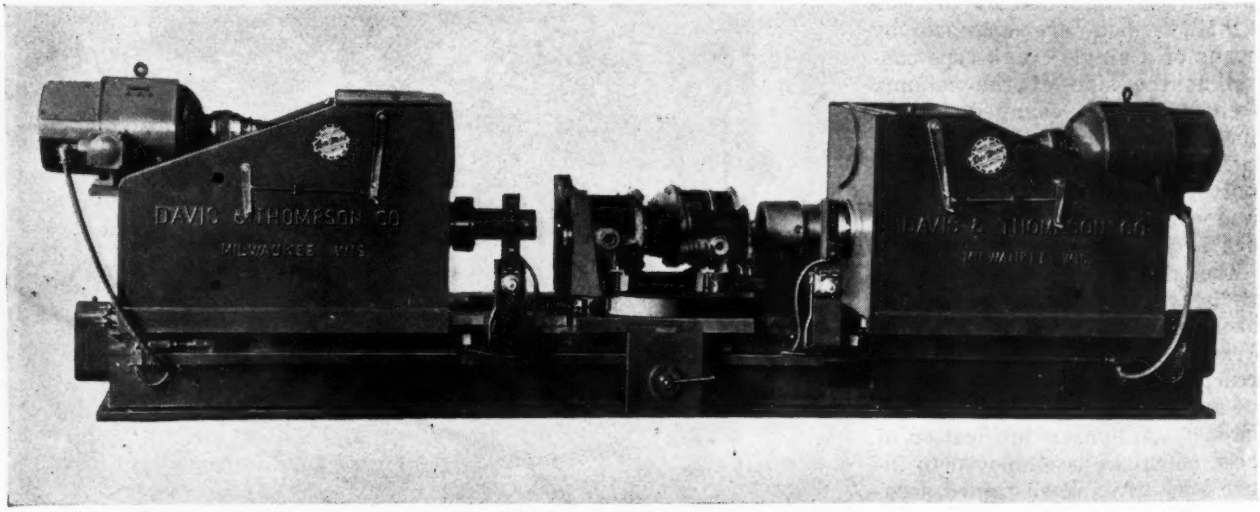
Safety features are incorporated in the head to prevent the clutch from being engaged without disengaging the gear train. Feed and rapid-traverse movements are obtained by screw drives operated individually by hydraulic motors. Two individual hydraulic pumps are used for the power feed. 71

Feedall Automatic Hopper Feed

A fully automatic self-contained hopper feeding unit has recently been placed on the market by the Feedall Machine & Engineering Co., 70 Vine St., Willoughby, Ohio. This compact, self-driven unit can be attached to a variety of high-production machines to eliminate hand feeding. The unit is capable of feeding cylindrical work up to 1 1/4 inches in diameter by 6 inches in length. It will also feed headed or shouldered work up to 1 1/8 inches in diameter by 6 inches in length. The feeding unit is driven by a 1/2-H.P. motor coupled to a variable-speed V-belt drive which can be adjusted while the machine in which it is applied is running.

Feedall Self-driven Automatic Work-feeding Unit

Some of the machines with which the Feedall unit can be used advantageously are centerless grinders, double-end grinders,



Davis & Thompson Two-way Boring Machine Equipped with Indexing Fixture for Boring Air Cylinders for Locomotives

To obtain additional information on equipment described on this page, see lower part of page 226.

automatic screw machines, drilling machines, and various types of special machines. This unit is also adapted for use in feeding work through induction heat-treating machines. 72

Power-Operated Bench Model Work Positioner

A power-operated bench model positioner for work weighing 100 pounds or less has just been brought out by the Industrial Division, Ransome Machinery Co., Dunellen, N. J. This positioner has been designed to meet the demands for a faster more efficient means of positioning small work in shops and laboratories. Built to handle small units, this machine will facilitate welding, assembling, repairing, grinding, hard-surfacing, and similar operations, positioning the work to the best advantage for the operator. With this device, work can be tilted to an angle of 135 degrees. The table can be locked in any position at any angle. It can also be revolved 360 degrees by a 1/8-H.P. single-phase reversible motor. A disengaging clutch permits free-wheeling of the table. A lever-operated pulley provides for a speed range of from 0.21 to 5 R.P.M.

Welding and work positioners from 100-pound hand- and motor-operated types up to 40,000-pound motor-operated positioners are available. Turning rolls and other special positioning equipment can also be furnished. 73

Bradford Overhanging Type Heavy-duty Buffing Machine

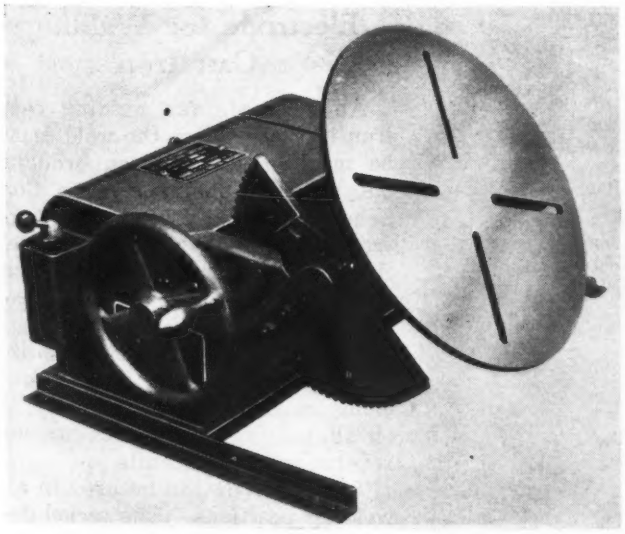
Bradford Heavy-Duty Buffing Machine

A heavy-duty overhanging type buffing machine, especially adapted for long and deep work requiring maximum clearance, is being manufactured by the Bradford Machine Tool Co., Cincinnati 4, Ohio. This machine is belt-driven by a ball-bearing motor built to meet NEMA specifications. The motor platform is adjustable for belt tension, and the design permits driving belts to be changed without removing the housing from the shaft. The machine is equipped with positive shaft lock, magnetic starter, overload protection, and under-voltage release.

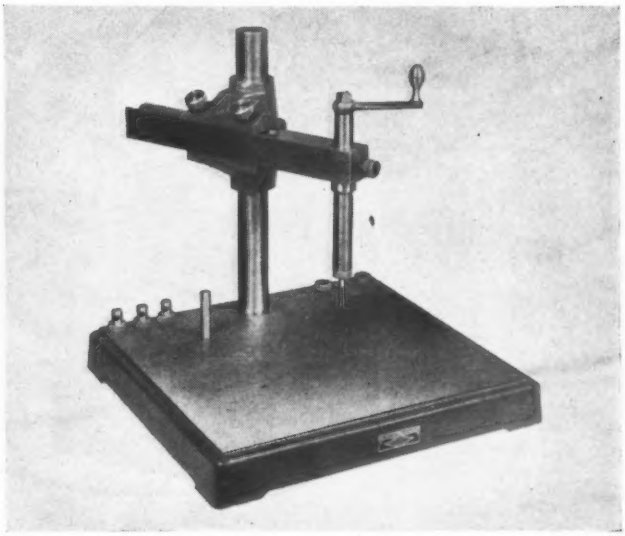
This model is produced in a power range of from 3 to 20 H. P. with a speed of 2400 R.P.M., or to customer's specifications. 74

Midget Precision Hand Tapper

A new small size precision tapping machine called the "Midget" has been added to the line of accessories made by the Producto Machine Co., 990 Housatonic Ave., Bridgeport 1, Conn., for use in tool and die shops. As shown in the illustration, the machine is



Power-operated Bench Model Work Positioner Built by Ransome Machinery Co.



Midget Precision Hand Tapper Made by Producto Machine Co.

To obtain additional information on equipment described on this page, see lower part of page 226.

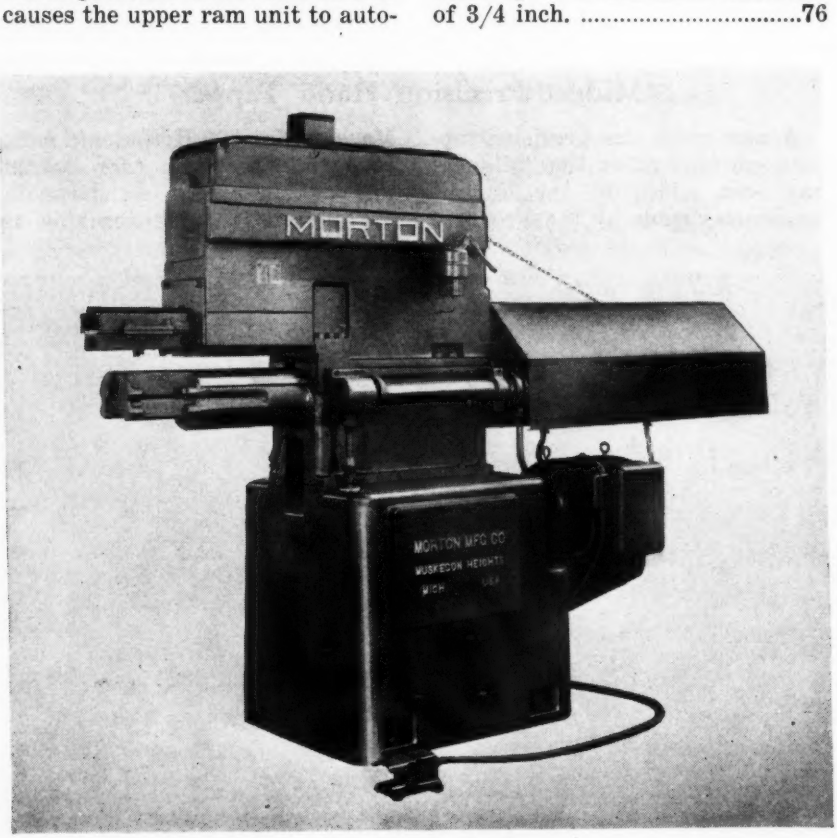
adapted for bench use, and has adjustments which permit the tap spindle to reach any working point within the table area. These hand tappers, now made in three sizes, are essentially adapted for use on accurate die and fixture work. They have removable spindles with a driving handle. The spindle accommodates individual bushings for all tap sizes within the capacity of the machine, which ranges from No. 4 to 1/4-inch taps, inclusive. The tapper shown has a base 15 1/2 by 15 inches, and weighs 62 pounds. 75

Morton Draw-Cut Flash-Trimming Machine

A high-duty, hydraulically driven, draw-cut flash-trimming machine for removing the flash or upset metal from resistance or butt welds has been developed by the Morton Mfg. Co., Broadway and Hoyt, Muskegon Heights, Mich. This machine can be furnished in sizes having capacities for taking draw cuts ranging from 12 to 28 inches, removing weld metal up to 1/4 inch thick. The regular distance from the center of the rams to the floor is approximately 55 inches, but this distance can be varied to suit special requirements. The machine is arranged with a lower horn for circular work, such as wheel rims or cylinders, and will accommodate work having a minimum diameter of 9 inches.

The operating cycle of the machine is automatic. The work is placed over the lower horn, after which pressure on the foot-starter causes the upper ram unit to automatically descend and clamp the work. The rams then trim the weld on the draw-cut or inward stroke. When the cut is completed, the upper ram is automatically raised approximately 2 inches and both rams return to the outward position and stop. The operator can remove the work as soon as the machine starts unclamping and place another piece in the trimming position.

Each ram is provided with three or more tool-holders, depending on the thickness and composition of the material. Adjustable-bit cutters of special design with a fine-pitch screw for adjustment are employed. A Morton electric cutter-grinder unit with gages and fixtures is available with the machine. This type machine can be furnished for trimming either cylindrical, rectangular, or flat work up to a maximum thickness of 3/4 inch. 76



Flash-trimming Machine Built by Morton Mfg. Co.

Multi-angle Vise Made by Manufacturers' Engineering Service

Multi-Angle Vise and Work-Table

The Manufacturers' Engineering Service, 408 Security Bank Bldg., Toledo 4, Ohio, is manufacturing a multi-angle vise designed as shown in the accompanying illustration. This vise has interchangeable and reversible hardened machine-steel jaws, 3 inches wide by 1 inch high, which open 2 inches. The table is 4 by 5 inches, and has a base which swivels through 360 degrees.

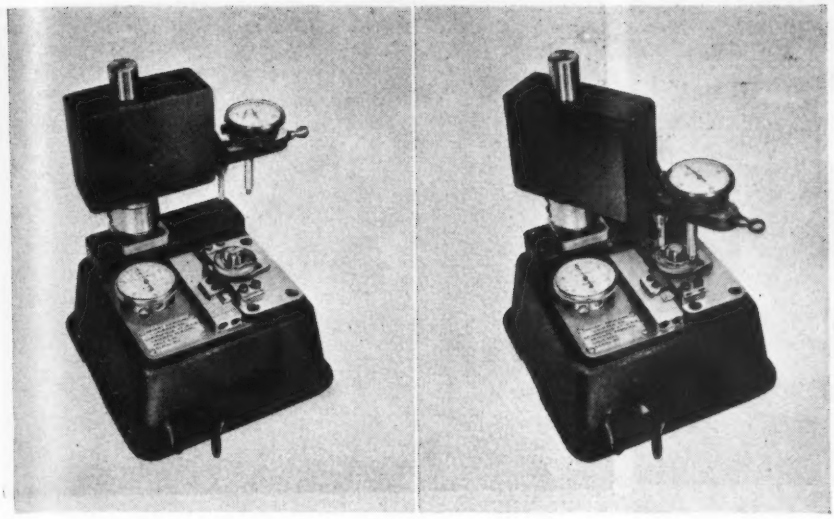
The vise jaws can be replaced with a work-table which can be tilted 45 degrees or more. Thus the vise and the table can be used for compound angle work. 77

Electrode for Welding Cast Iron

An electrode for welding cast iron in cases where the weld must be machinable has been brought out by the General Electric Co., Schenectady, N. Y. This new electrode is composed of pure nickel core wire and an extruded black covering, which is largely consumed in the arc and produces very little slag. The arc stabilizing ingredients used in the covering make this electrode useful on alternating- and direct-current reverse-polarity circuits.

The electrode can be used in all welding positions. The nickel deposit eliminates hard zones in the welds and matches the color of the work. 78

To obtain additional information on equipment described on this page, see lower part of page 226.



Bryant Gage for Checking Face Squareness of Threaded Parts Shown in Loading and Gaging Positions

Bryant Gage for Checking Face Squareness of Threaded Parts

The Bryant Chucking Grinder Co., Springfield, Vt., has developed a new gage for checking the relationships between the pitch diameter of a thread and the face of the part. This new "Squareness-of-Face" gage, as it is called, can be mounted on any regular Bryant thread gage. It consists of a movable arm, which carries a large dial indicator, and two contact points which can be adjusted to cover the capacity range of the thread gage. The inner contact member serves as a pilot and compensates for thread progression as the part is turned for inspection. The front contact actuates the dial indicator on the face gage.

In operation, the control lever is employed to withdraw the thread segments behind guides. The part is then placed in the gage, where it is engaged by three thread segments. Next it is given one-third of a turn for all-over thread inspection, which is recorded visually on the thread-gage dial indicator. The "Squareness-of-Face" gage is then swung into position, as shown in the view to the right. An additional half turn now serves to check the angularity of the face with the thread, this gaging operation being recorded visually on the other dial indicator. The thread segments are then withdrawn by the control lever, so that the part can be lifted from the gage without requiring it to be unscrewed from the gage segments.

Each gage is furnished with a master setting ring having one face ground square. Various models of this gage are available for inspecting internal threads which range from 3/8 inch to 8 inches in diameter. 79

B & S Grinding Machines with New Electrical Control Enclosures

The No. 5 plain grinding machines made by the Brown & Sharpe Mfg. Co., Providence 1, R. I., are now being furnished with improved enclosures for the electrical controls. The new enclosure or compartment, located on the right hand side of the machine, as shown in Fig. 1, is designed to give maximum protection combined with accessibility.

While the headstock, table, grinding wheel, and coolant pump of this machine are driven by separate motors, one dust- and moisture-proof push-button switch on the control compartment governs the starting and stopping of the machine. The magnetic controls, individual motor overload relays, transformer for the control system, and main line disconnect switch are all mounted in the compartment. When the opening lever on the compartment door is turned, a safety device actuates the main line disconnect switch and shuts off the current.

The cover of the control com-

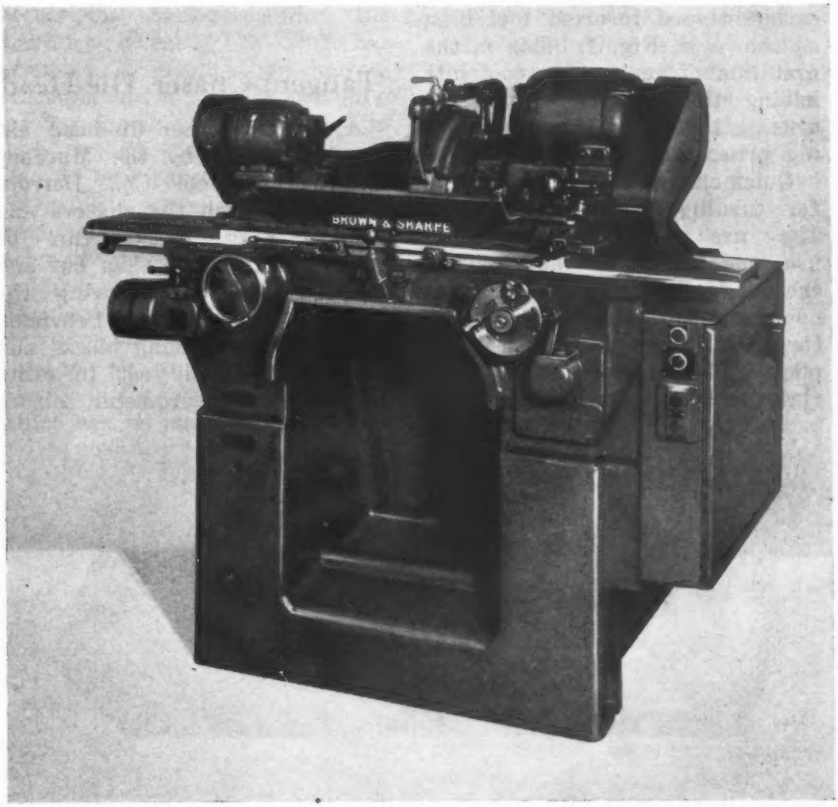


Fig. 1. Brown & Sharpe Grinding Machine with Enclosed Electrical Controls

To obtain additional information on equipment described on this page, see lower part of page 226.

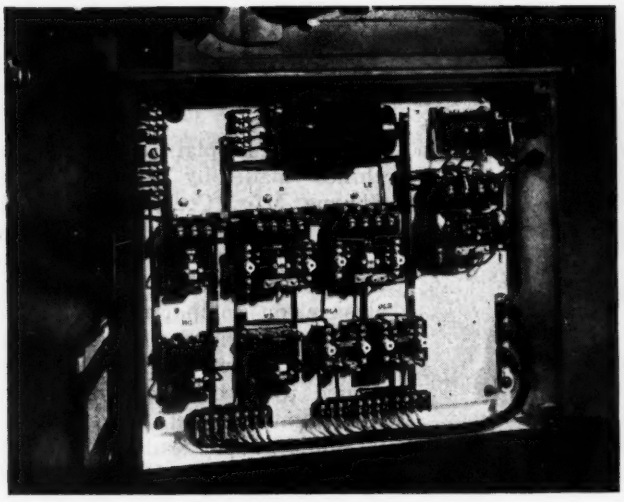


Fig. 2. Control Equipment of Brown & Sharpe Grinding Machine Shown in Fig. 1

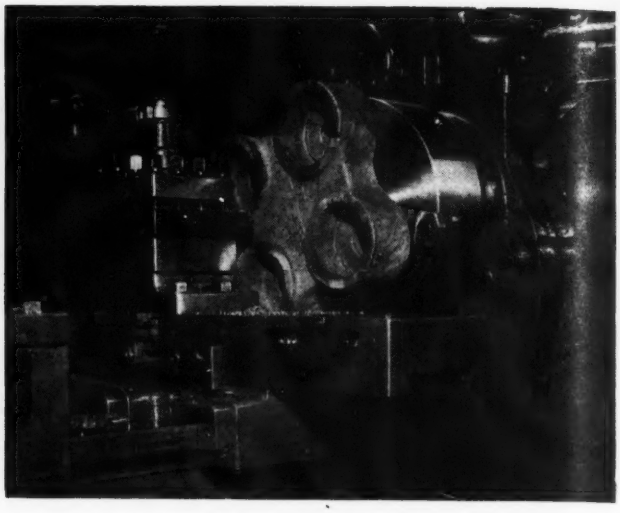


Fig. 2. Carbide-tipped Inserted-bit Tool Taking Interrupted Cut on Steel Casting

partment is provided with a gasket, and is so designed that solids or liquids falling on top of the enclosure will be deflected from the cover gasket. 80

Single-Point Tools with Carbide-Tipped Bits

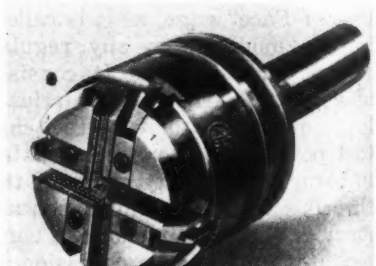
The O.K. Tool Co., Inc., Shelton, Conn., has brought out a new line of single-point tools with carbide-tipped inserted tool bits, as shown in Fig. 1. This is the first line of replaceable tool bits having the carbide secured by brazing to employ the O.K. locking principle.

Quick-change tips are available for turning, boring, or facing. They are ground for immediate use and to meet the varying characteristics of the material to be machined. Outstanding features of these tools are the simplicity of the holder lock, the rigid design developed to take the thrust resulting from high-speed operation, comparatively large amount of carbide available when regrinding, and ease with which the regrinding operations can be performed. One of these inserted carbide-tipped tool bits is shown in Fig. 2 taking an interrupted facing cut on a steel casting. This tool is taking a cut 1/8 inch deep with a feed of 0.012 inch at a surface speed of 308 feet per minute. 81

Tangent-Chaser Die-Head

A tangent-chaser die-head has been developed by the Murchey Machine & Tool Co., Detroit, Mich., in which the chasers and chaser-holding blocks can be quickly and easily taken out and replaced without removing the tool from the machine. Provision is made for replacing blocks and chasers previously set to exact location in a micrometer setting fixture. This arrangement enables one die-head with extra chasers and blocks to take the place of two or more complete set-ups, reducing machine "down time."

These die-heads are furnished in revolving and stationary types with interchangeable chasers and holding blocks. A rotating-yoke operated tool for use on automatic screw machines, drill presses, or any machine in which the tool revolves is shown in the illustration. 82



Murchey Tangent-chaser Die-head

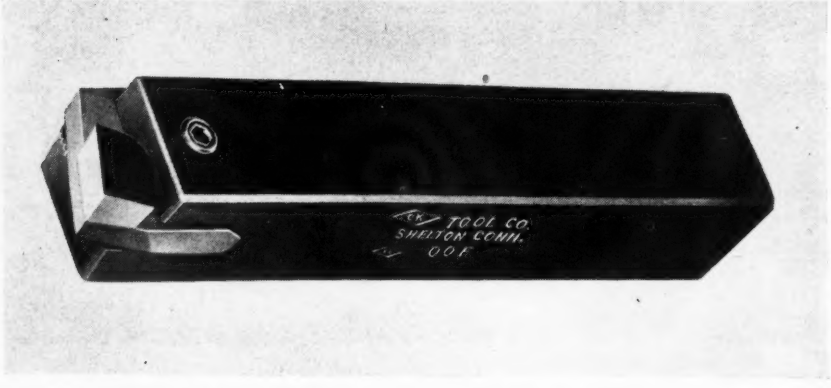
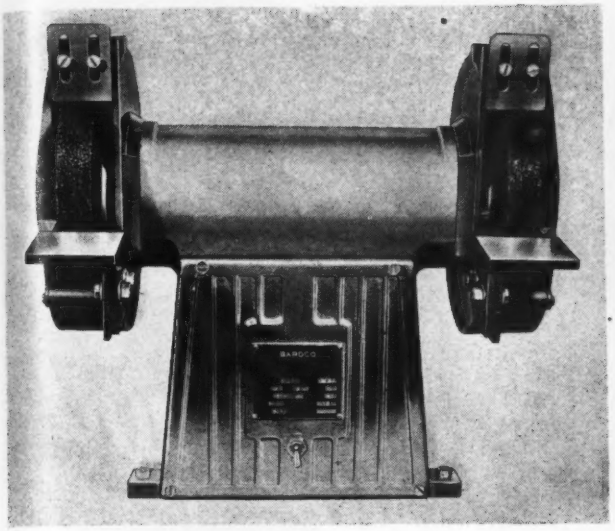


Fig. 1. Tool with Carbide-tipped Inserted Bit Made by O.K. Tool Co.

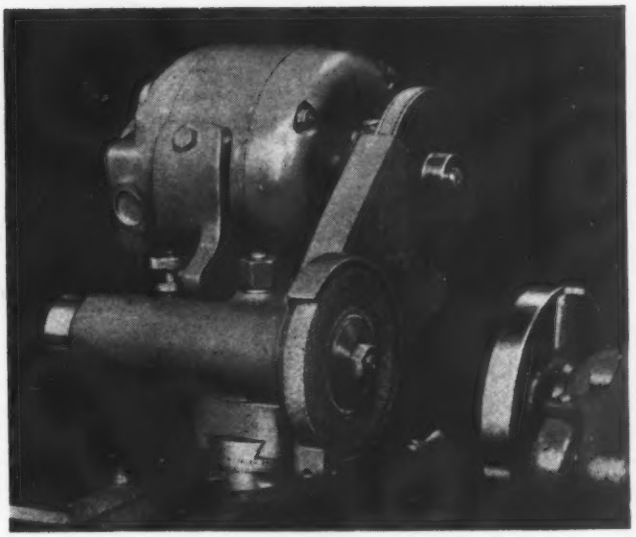
Bardco Bench Grinder

A new type of bench grinder with a special small-diameter motor, designed to provide greater work clearance between the two grinding wheels, has been announced by Bardco Mfg. & Sales Co., 2450 E. 23rd St., Los Angeles, Calif. Absence of any projections between the wheels permits unobstructed motion of the work, and also allows the grinding wheel

To obtain additional information on equipment described on this page, see lower part of page 226.



Bardco Bench Grinder Designed with Maximum Clearance between Wheels



Lathe Grinding Attachment Brought out by South Bend Lathe Works

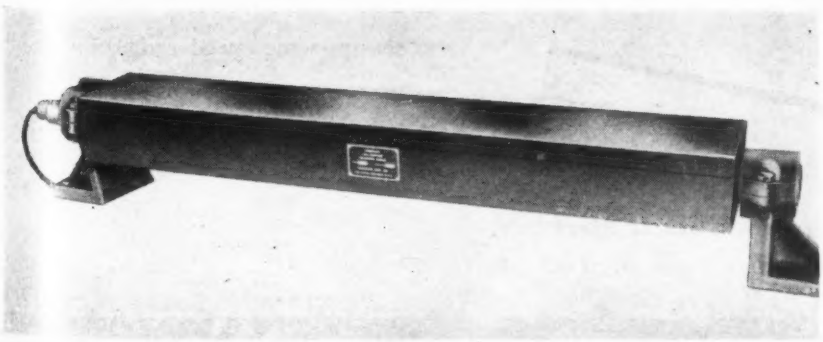
to be used until worn down to a smaller diameter than has previously been possible. Since the diameter of the motor is approximately equal to the diameter of the retaining rings of the grinding wheel, practically the entire abrasive portion of the wheel can be utilized.

The grinder base and motor housing are cast aluminum, with smooth contours designed to shed dust and metal particles. The grinder operates at a speed of 3600 R.P.M., and is furnished in models with 7-, 8-, or 10-inch wheels. Standard equipment includes two wheels and two enclosed wheel guards with adjustable tool-rests and spark shields. 83

Hanchett Magnetic Bar for Knife-Grinding Operations

The Hanchett Mfg. Co., Big Rapids, Mich., has developed an electromagnetic bar designed to hold knives to the extreme edge of the bar, where holding power is most important. The top plate is made by laminating alternate vertical strips of non-magnetic material and carbon steel. Even distribution of the holding power makes it possible to hold small parts securely in position at every point on the top plate.

This bar has been designed for maximum convenience in securing a precise angle adjustment between the work-piece and the grinding wheel. The knife-bar assembly is mounted on journal brackets, which permits swiveling the bar through 360 degrees. On these models, the desired angle is secured by means of a handwheel operating a worm and worm-gear mechanism. The bar can be locked securely in the desired position. Holding power is supplied by the Hanchett "Hermeti - Coil" construction, which eliminates failure due to moisture and coolants. Auxiliary top plates are available which can be machined to the required contours for special jobs...84



Hanchett Magnetic Bar Designed to Facilitate Knife Grinding

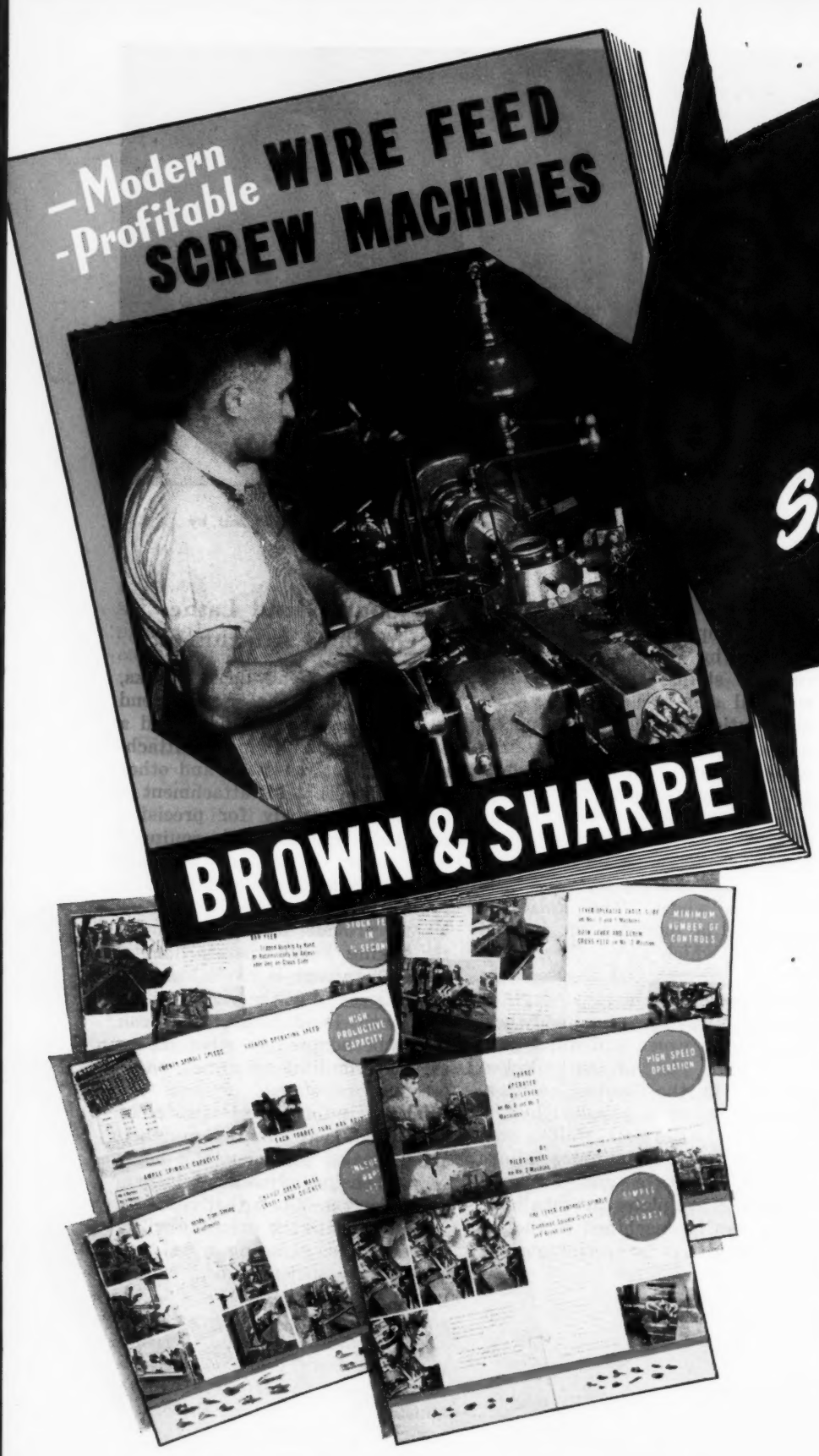
South Bend Lathe Grinding Attachment

The South Bend Lathe Works, 383 E. Madison St., South Bend 22, Ind., has recently developed a powerful electric grinding attachment for use on lathes and other machine tools. This attachment is designed primarily for precision external grinding. It is equipped with a 4- by 1/2-inch grinding wheel driven by a constant-speed, continuous-duty 1/4-H.P. motor, which provides sufficient power for taking heavy sustained cuts. The attachment is available with frame sizes to fit the various sizes of South Bend lathes, and can easily be adapted to other makes of lathes, milling machines, shapers, planers, etc.

The grinding-wheel spindle of the attachment runs on prelubricated, sealed precision ball bearings. Tension adjustment is provided for the V-belt that connects the motor with the grinding-wheel spindle. The grinding wheel and V-belt are enclosed in a single guard.

Spring - stops for grinding straight- and spiral-fluted reamers and cutters, diamond dressers for truing the grinding wheel, and holding fixtures for the dressers can be furnished with the attachment. Wheels are available in several grades for grinding various materials, including tungsten carbide, tool steel, machine steel, cast iron, bronze or brass, aluminum, Bakelite, and rubber. Special cup-wheels are supplied for reamer and cutter grinding. 85

To obtain additional information on equipment described on this page, see lower part of page 226.



This 32 ... show you

MINIMUM NUMBER OF CONTROLS—waste motion eliminated—operator fatigue reduced—efficiency raised.

SIMPLE TO OPERATE—full control of spindle movement concentrated in single lever—a definite aid to production.

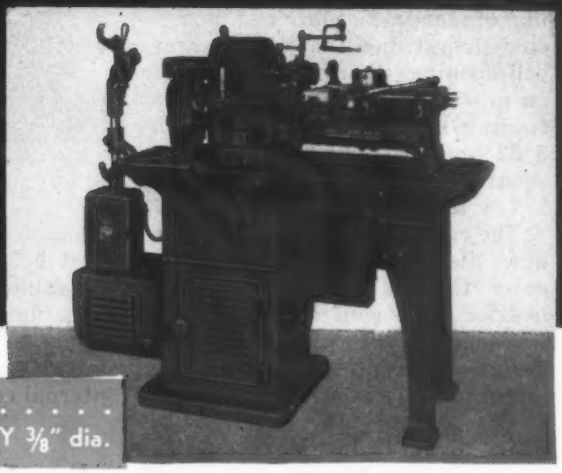
UNUSUALLY RAPID SET-UP—change-overs made quickly—doubly important for short-run or second operation work.

HIGH PRODUCTIVE CAPACITY—obtained by simplified controls, rapid set-up, wide speed range and ample power.

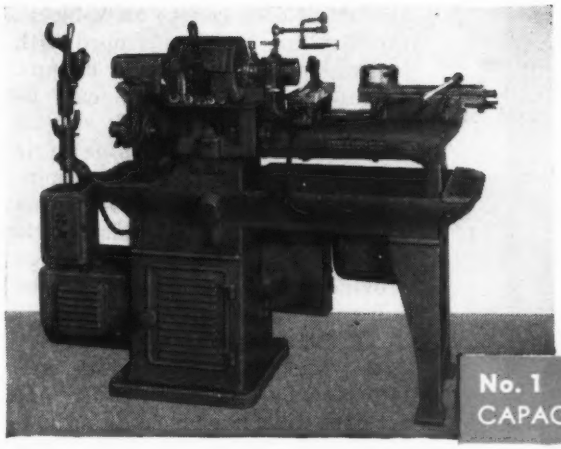
Write for copy of this book on Wire Feed Screw Machines.
Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

BROWN &

page book will IMPORTANT PRODUCTION ADVANTAGES



No. 0 . . . . . .
CAPACITY 3/8" dia.



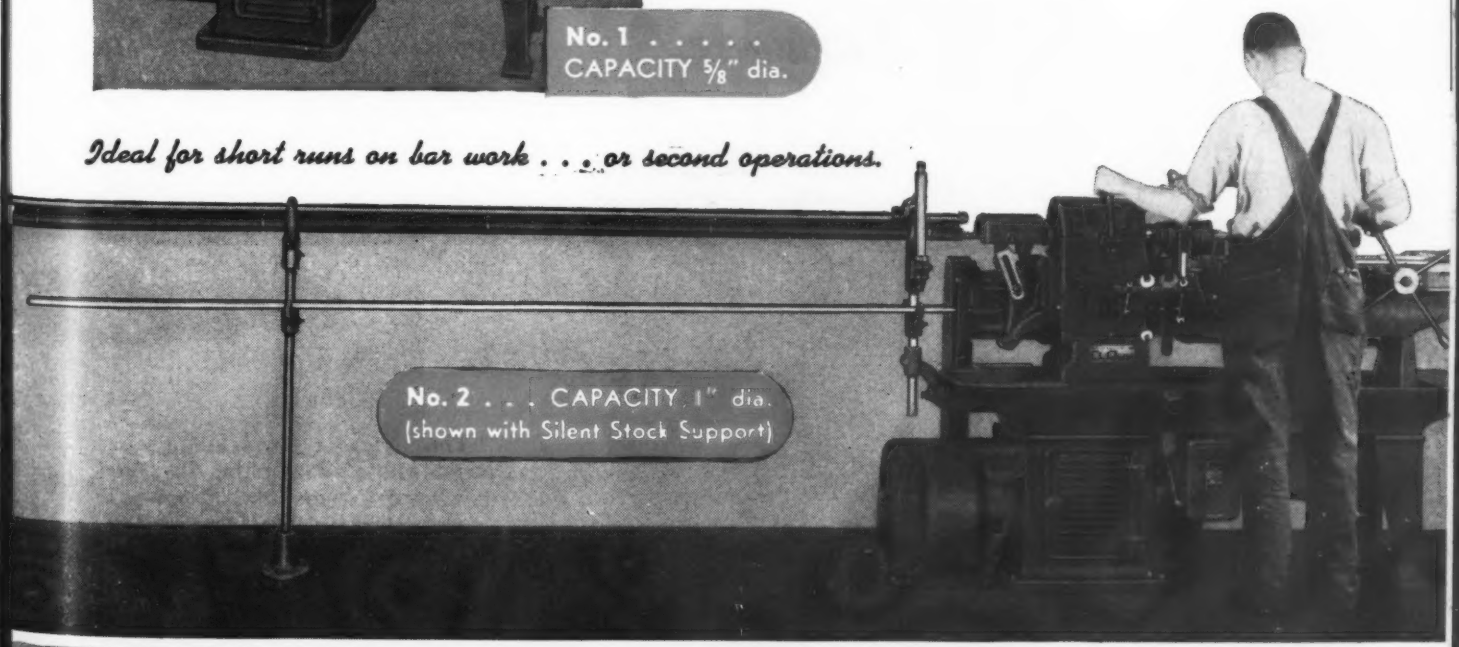
No. 1 . . . . . .
CAPACITY 5/8" dia.

20 changes of spindle speed . . . in 10 high-low speed combinations.

High ratio between high and low speeds . . . forward and backward, or all in same direction.

One lever controls spindle . . . combined spindle clutch and brake lever.

Ideal for short runs on bar work . . . or second operations.



No. 2 . . . CAPACITY 1" dia.
(shown with Silent Stock Support)

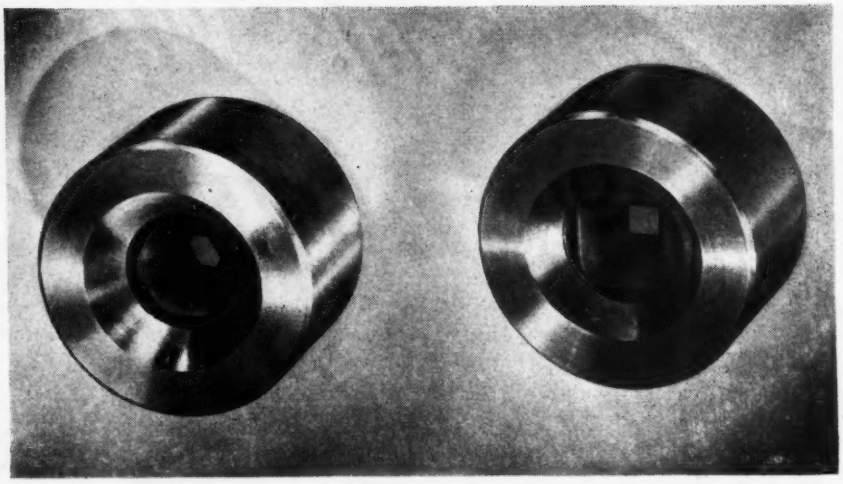
SHARPE

B·S

Carboloy Dies for Square and Hexagonal Work

In order to allow greater latitude in the angle at which stock can be fed into dies, to permit faster die finishing and servicing, and to provide for better lubrication of both die and stock, the Carboloy Company, Inc., 11147 E. Eight Mile St., Detroit 32, Mich., has placed on the market a new line of standard square and hexagonal-shaped dies that have larger bell openings than those provided on previous designs. The new dies cover a range of hole sizes from 5/32 inch to 1 5/8 inches for square dies and from 5/32 inch to 1 7/8 inches for hexagonal dies.

The enlarged bell opening in the new dies permits the stock to enter the die carrying an even heavier coating of lubricant than was possible with dies of previous design. It also reduces the amount of extraneous stock that must be removed from the entering angles of the die when making up a finished die from a rough-shaped blank. The new die design provides for easier access to the internal contour surfaces. 86



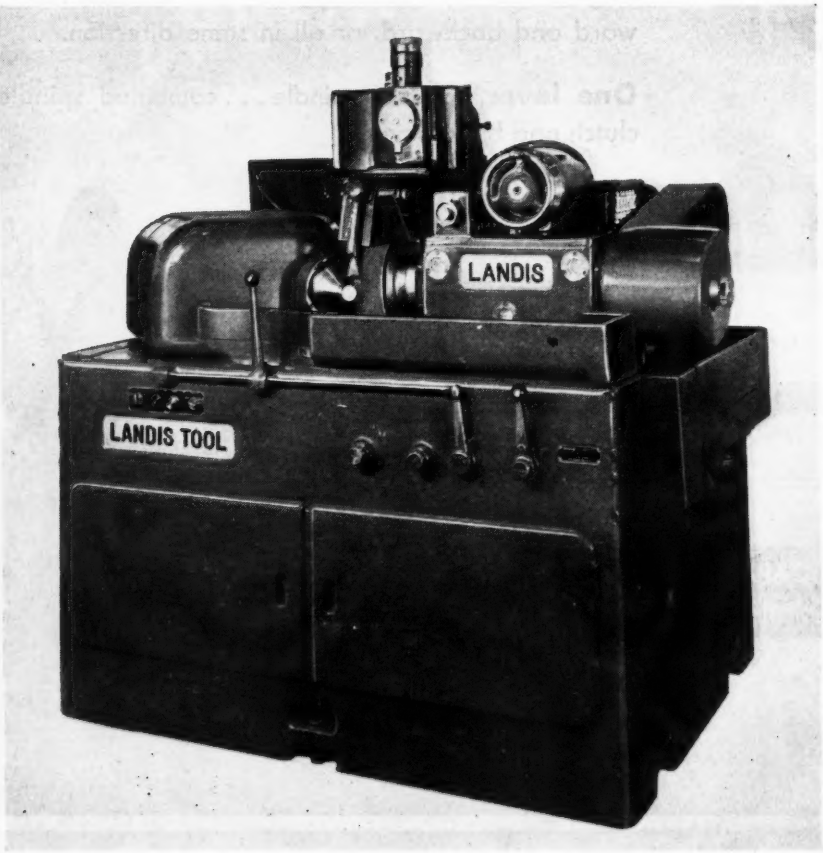
Hexagonal and Square Dies of Improved Design Made by the Carboloy Company

Landis Valve-Grinding Machine

The Landis Tool Co., Waynesboro, Pa., has announced a completely new machine for grinding automotive and airplane valves to an exact seating surface. A low operator fatigue factor and increased production obtained by a reduction in "down time" are outstanding advantages claimed for this machine. It will handle valves with face angles ranging from 0 to 62 1/2 degrees, and face diameters of 7/16 inch to 3 1/2 inches.

The "Microsphere" bearing headstock uses collets or V-blocks for chucking and is equipped with hydraulically operated clamps. Loading and unloading can be done while the headstock spindle is rotating or the machine cycle can be arranged to stop the spindle when the grinding operation is completed. The headstock is mounted on a fixed table which provides adequate support for the full swiveling range.

The wheel-spindle is also mounted in "Microsphere" bearings, and is driven by a 3-H.P. motor. The reciprocating movement is adjustable from 0 to 5/8 inch. The standard size wheel employed on this machine is 20 by 1 by 8 inches. The hydraulic oil reservoir holds 32 gallons, and the coolant reservoir 42 gallons. The machine weighs 8700 pounds. 87



Valve-grinding Machine Brought out by the Landis Tool Co.

Unground Radial Bearings

The Nice Ball Bearing Co., Nicetown, Philadelphia, Pa., has developed a new line of low-cost unground radial bearings, designed for adaptation to applications requiring inexpensive, yet high quality annular bearings. These new units are recommended for medium loads and for maximum speeds of approximately 2500 to 3000 R.P.M.

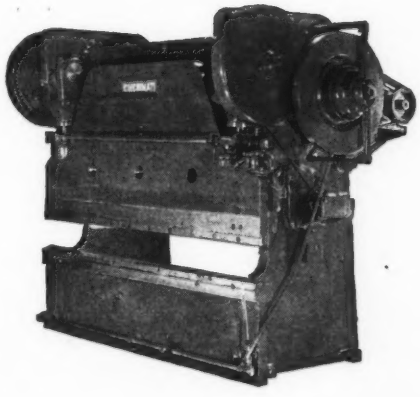
To obtain additional information on equipment described on this page, see lower part of page 226.

1. Closing end fin.
2. Trimming and notching corners.
3. Piercing and forming Prestoles.
4. Forming end flange.

Four Operations

ONE STROKE

Courtesy of Surface Combustion Corporation, makers of Janitrol Unit Heaters.



Progressive operations on Cincinnati Press Brakes reduce time and cut costs. They are one type of the almost endless applications of these machines.

Here we show a typical example of the profitable application of progressive, simultaneous operations. Four operations are completed on the first stroke; three on the second.

We suggest you write our Engineering Department about your individual forming problems, or call our representative near you for advice and suggestions.

Write for Catalog B-2.

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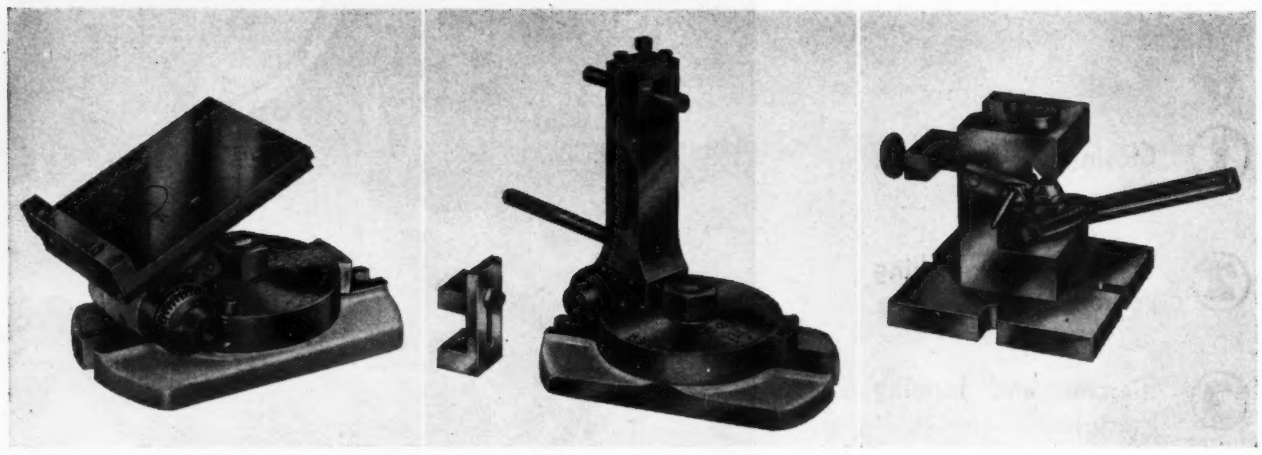


(Left) Matco Angle-plate. (Center) Form Dresser. (Right) Universal Drill Jig

The new bearings have one-piece steel inner and outer races, heat-treated to a uniform hardness. A ball retainer or separator of the two-piece type reduces ball contact friction and increases the range of allowable speeds. Although these bearings are designed primarily for radial loads, the ball groove provides considerable thrust capacity.

All bearings of the new series are finish-ground on the outside diameter to a tolerance of 0.0006 inch, and are held to a tolerance of 0.005 inch on the inside diameter. They are available with double shields, with one shield, or without shields, and can be furnished grease packed or without grease, as desired. 88

Matco Angle-Plate, Form Dresser, and Universal Drill Jig

The Matco Tool Co., 2830-36 W. Lake St., Chicago 12, Ill., has recently developed an angle-plate of the universal type, shown in the view to the extreme left in the illustration; a form dresser, shown in the central view; and a universal drill jig and fixture, illustrated in the view to the right.

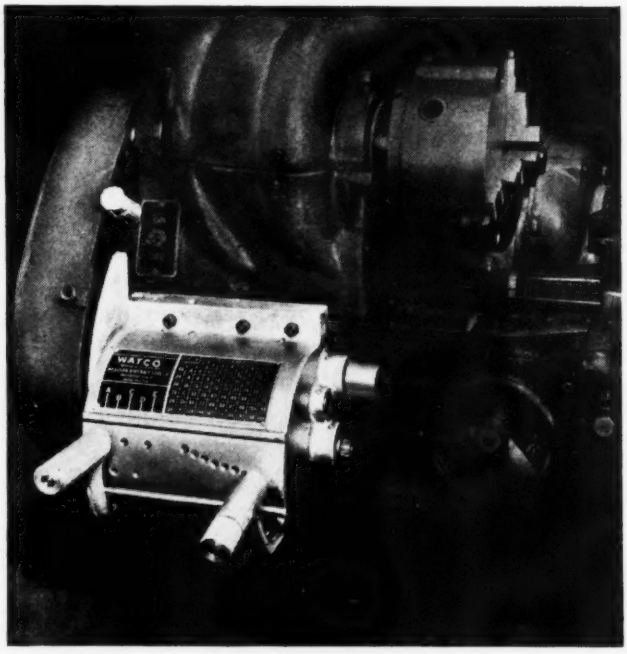
The angle-plate is designed for use in angular drilling, grinding, and gaging operations as well as general tool and die work. It can be employed for dressing angles on grinding wheels by sliding the truing diamond holder along the ways of the top plate. The compound-angle settings available with this angle-plate, together with other versatile features, adapt it for a wide range of tool-room and inspection work. The plate surmounting the swivel base is 3 1/2 by 4 1/2 inches.

The form dresser is designed to facilitate accurate radius dressing of grinding wheels. When mounted on a cutter or surface grinder, this dresser will handle any concave or convex radius forming or dressing to a 1-inch circle on wheels up to 10 inches in diameter. Larger radius forming can be done by tilting the column.

The universal drill jig has a 4- by 4- by 1/2-inch removable base, and is 3 7/8 inches high. Using the thumb-screw for a positive stop and the adjustable anvil for a locating base, holes ranging up to 5/16 inch in diameter can be accurately drilled and duplicated in stock up to 3/4 inch in diameter. A cam-action handle is provided for quick locking. The larger V-groove will accommodate work up to 1 inch in diameter. 90

Lathe Quick-Change Gear-Box

A quick-change gear-box designed for attachment to small standard lathes has been brought out by the Western Aircraft Tool Co., 2505 N. Ontario St., Burbank, Calif. This gear-box is applicable to Atlas, Craftsman, Logan, Powercraft, and the South Bend 9- and 10-inch Model B and C lathes. It will cut accurate threads ranging from 4 to 224 per inch, and can be easily installed, no machine work other than the drilling and tapping of four holes being necessary. 89

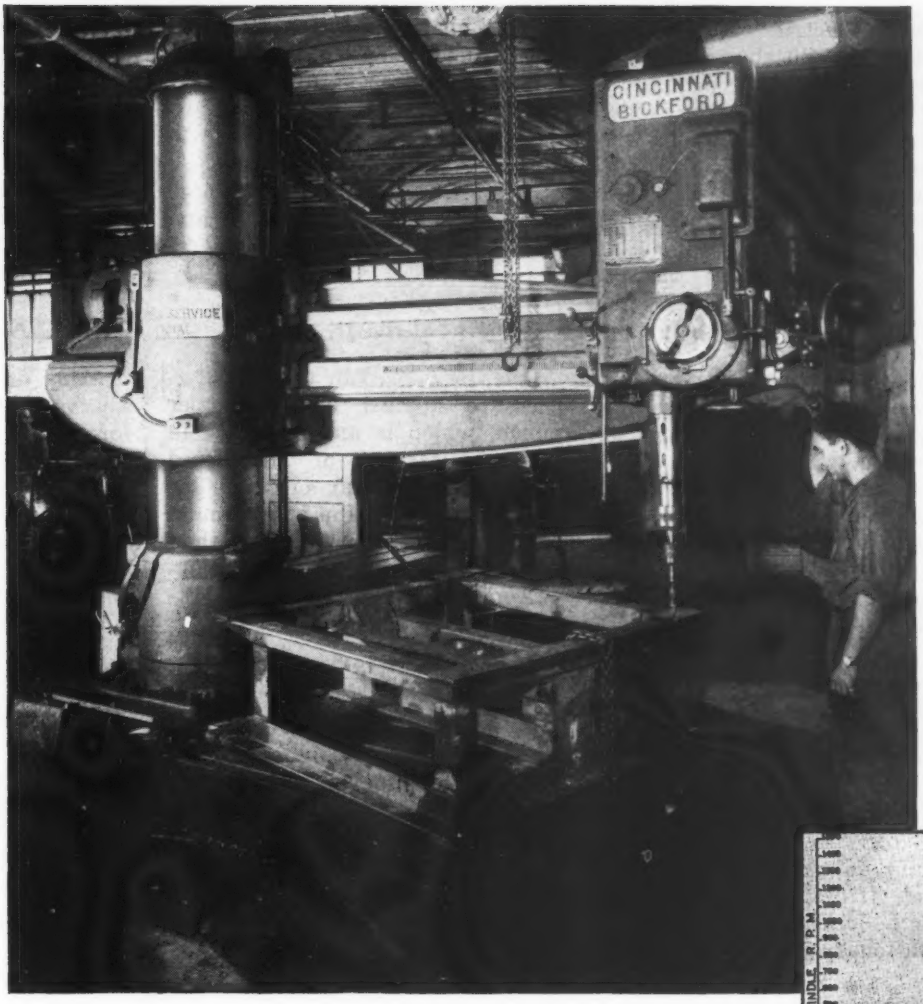


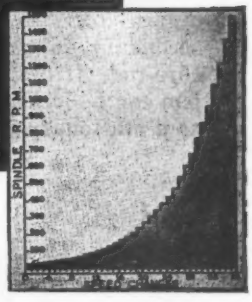
Quick-change Gear-box Attachment for Lathes

Westinghouse Electrodes

A direct-current, reverse-polarity electrode for welding low-alloy cast steel or low-alloy high tensile strength rolled steels in all positions has been announced by the West-

To obtain additional information on equipment described on this page, see lower part of page 226.





36 speeds—no gaps or duplication—with only 17 gears.

THE SPEEDS AND FEEDS YOU NEED FOR THE JOB

FEED IN THOUSANDTHS AND THREADS PER INCH
DOTTED LINE INDICATES NEUTRAL AND HAND FEED POSITION

POSITION OF FEED CHANGE LEVER									BACK GEAR LEVER
1	2	3	4	5	6	7	8	9	
25	21	17	14	12	10	8½	7	6	→
[illegible]	103	[illegible]	[illegible]	59	50	42	35	29	←

- *18 rates of power feeds from .006" to .125" per revolution include standard tap leads.*

Equal Efficiency of Every Unit Makes the Balanced Machine

Twelve three-quarter-inch holes are being drilled and tapped at a 75% saving over a former method.

This Cincinnati Bickford Super Service Radial Drill is called upon to do a great variety of small lot jobs in this shop.

The range of feeds and speeds and the extreme ease of handling have made this versatile drill very profitable.

Write for detailed Bulletin R-24A.

See our condensed catalog in Sweet's File.

RADIAL AND UPRIGHT SUPER SERVICE DRILLING MACHINES

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9, Ohio U.S.A.

inghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa.

This AP-MO electrode is designed for making butt and fillet welds, and is available in three diameters, from 1/8 to 3/16 inch.

Another new electrode has been brought out by the company for welding low-alloy cast steel or low-alloy high tensile strength rolled steels in the flat position, with alternating- or direct-current straight polarity. This DH-MO electrode is available in four diameters, from 5/32 to 1/4 inch. It is designed for the high-speed welding of grooved joints, and positioned and horizontal fillets...91

General-Purpose Powdered-Metals Press

To meet the demand for greater pressures and higher production in compacting a wide range of powdered-metal parts the F. J. Stokes Machine Co., Philadelphia 20, Pa., has brought out a cam type press of 40 tons capacity, designed to operate at speeds up to 30 strokes per minute. This press is similar in design to the Stokes Model "S" press.

The new press is a fully automatic machine, in which independent cams control the synchronized movements of both upper and lower punches. It is equipped with a compound lower punch, designed to operate either as a secondary punch or as a movable core-rod. If desired, this mechanism can be locked in place to serve as a stationary core-rod.

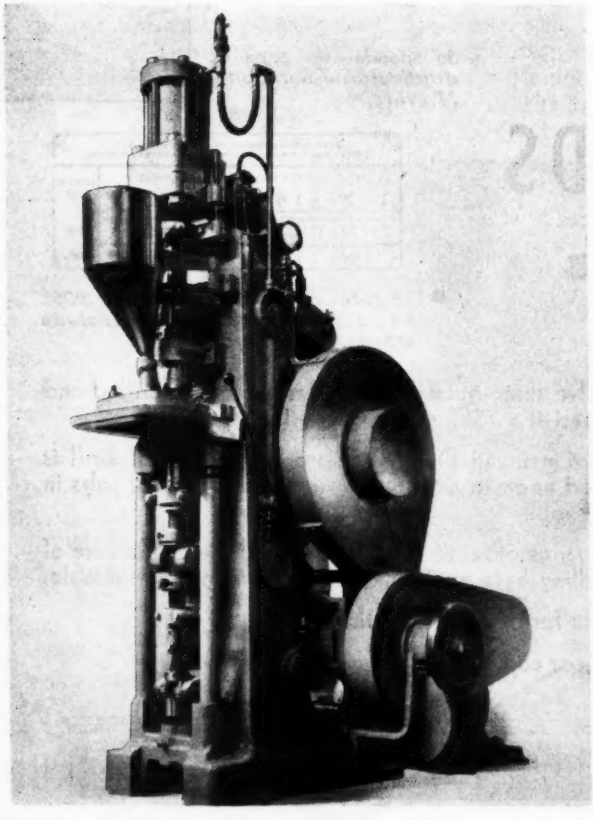
The die table can take the full pressure applied by the upper punch, which is an advantage in the manufacture of shouldered bushings or similar pieces. The upper punch is timed to remain out of the way during more than 110 degrees of the cycle before descending rapidly and then slowly compressing the metal powder. This feature facilitates the feeding of materials that are difficult to handle, and is especially advantageous in making parts with thin walls. The maximum die fill is 6 1/4 inches, and the maximum diameter of a piece that can be pressed is 3 inches.

Built into the press is a lever-operated combined clutch and brake which speeds up set-up time and provides means for instantly starting or stopping the machine. The variable-speed drive provides for production rates of from 10 to 30 pieces per minute, depending upon the material, size, and intricacy of the piece. The machine weighs about 12,000 pounds, including the variable-speed drive and a 7 1/2-H.P. motor. 92

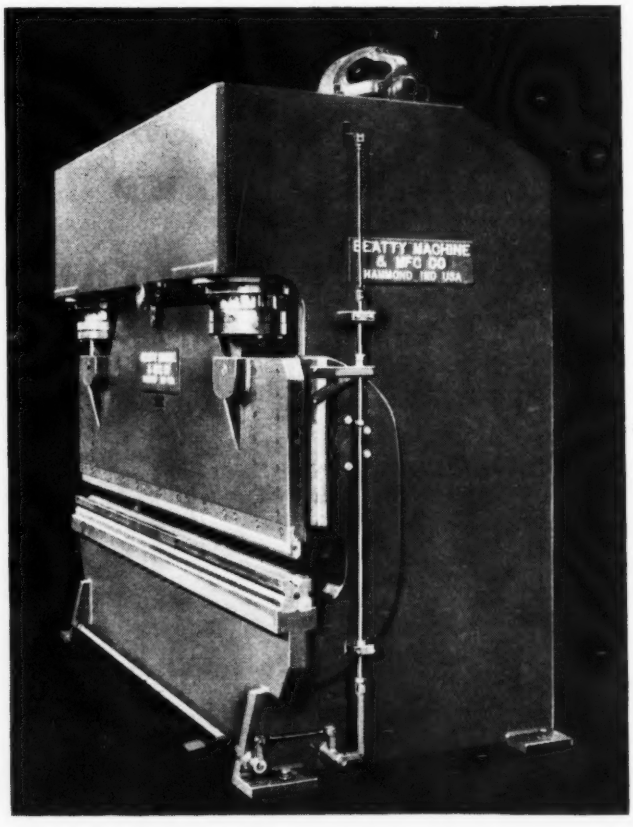
Beatty Hydraulic Press Brake

A hydraulic press brake of 300-ton capacity, designed to provide a maximum amount of flexibility, has been introduced to the trade by the Beatty Machine & Mfg. Co., Hammond, Ind. This machine is adaptable to a wide variety of V-bending, flanging, pressing, and straightening, and handles a wide range of plate thicknesses without the need for minute ram adjustment.

The ram advances at a maximum rate of 310 inches per minute, and returns at 285 inches per minute. Pressing under full load is accomplished at the rate of 14 inches per minute. These speeds

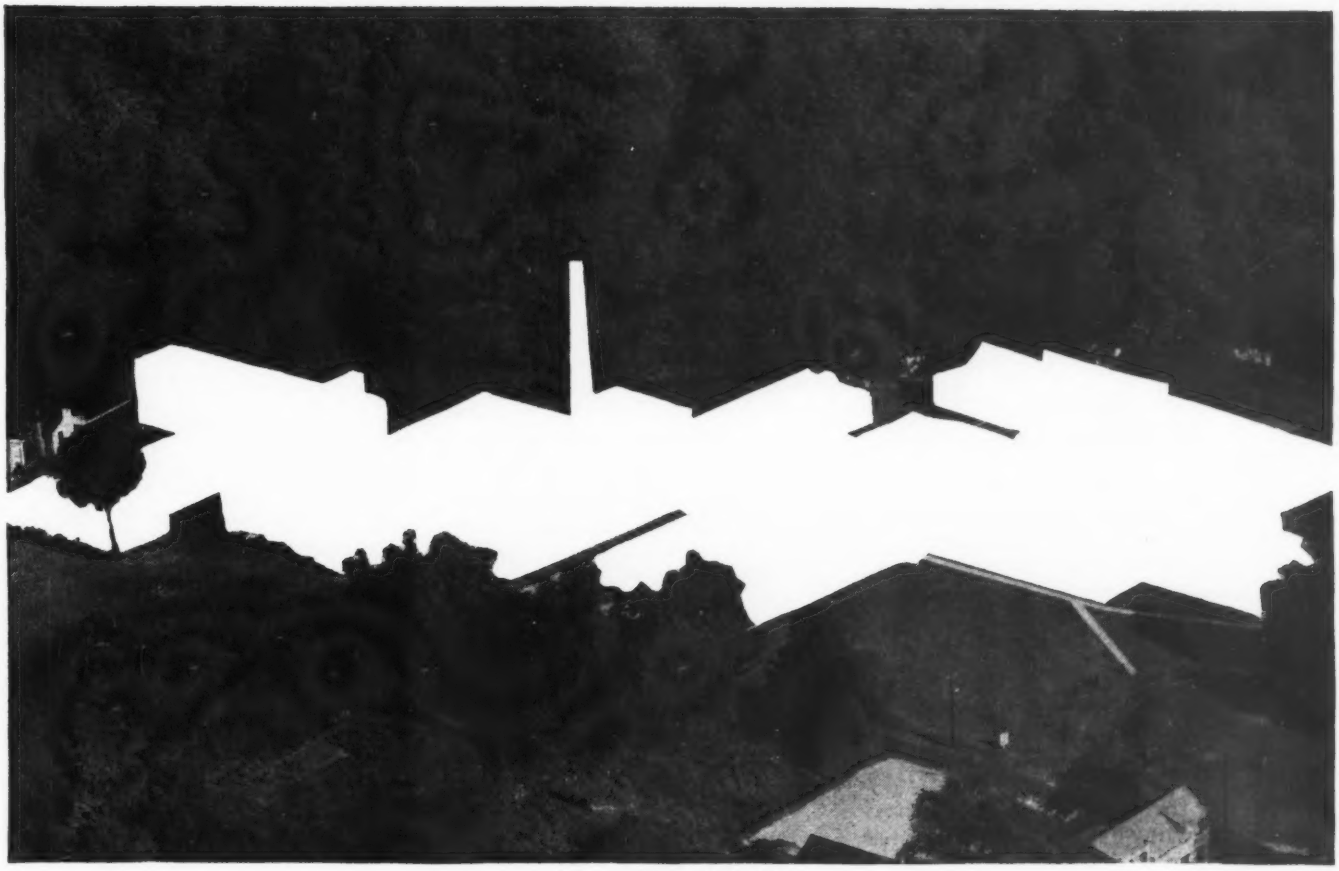


Stokes Powdered-metals Press



Beatty Hydraulic Press Brake

To obtain additional information on equipment described on this page, see lower part of page 226.

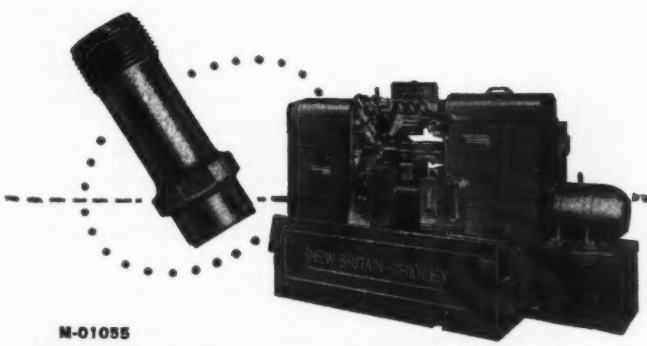


THE PLANT NOBODY HAS EVER SEEN

INDUSTRIAL engineers, labor leaders, management men agree that there never yet has been a manufacturing plant in America that has achieved its absolute maximum of production. Suppose one did exist in which management provided every possible facility, employees used them to the utmost, and management in turn regularly devoted a substantial share of the plant's earnings to invest in more and more efficient machines and methods. Certainly high wages and good returns on stock owners' investments would be no problem to such a business.

Perhaps the absolute ideal plant will never exist, but the tools exist *right now* to enable almost any manufacturer and his employees to achieve spectacular improvements for their mutual welfare. Such an opportunity lies in management's providing the finest, modern production machinery and the latest production methods. In employees' using such machines for all they are worth. Read below how one manufacturer is taking advantage of this opportunity.

EXAMPLE: The aircraft part shown below, is typical of swift, economical, accurate automatic screw machine performance. Speed is maintained by breaking down the inside boring and reaming into four operations. A total of eleven tools work on this piece which is threaded and cut off in the last position, and close limits of concentricity must be maintained between threads and bore. Regular day by day production: 312 pieces per hour.



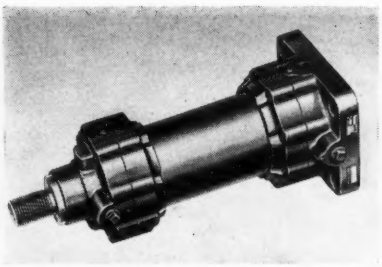
N-01055

New Britain Automatics

THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN-GRIDLEY MACHINE DIVISION
NEW BRITAIN, CONNECTICUT

are variable between zero and the maximum.

The new machine is of the open-throat, closed-housing type, and is built in capacities of from 200 to 600 tons, and in sizes of from 8 1/2 feet to 12 1/2 feet between housings. Stroke control features are incorporated to facilitate operating during any portion of the stroke. 93



Hannifin Hydraulic Cylinder

Cincinnati Bickford Radial Drill Equipped for Portable Use

A "Super-Service" radial drill mounted on a prefabricated steel "gondola" base of unique design, developed for portable use, has been announced by the Cincinnati Bickford Tool Co., Oakley, Cincinnati 9, Ohio. This radial drill has a 4-foot arm and a column 13 inches in diameter. The base is 110 1/8 inches wide, and is equipped with hardened steel wheels. Power clamping and power traverse at the rate of 24 feet per minute with push-button control are features of this machine. As shown in the illustration, the machine has a shortened column and a large lifting bail attached to a steel cap. 94

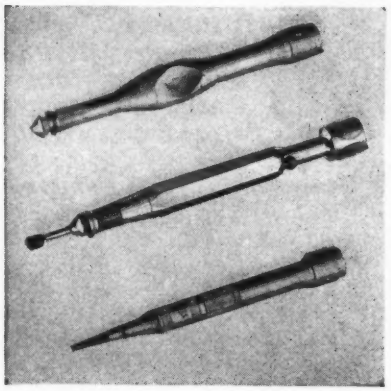
Hannifin Hydraulic Cylinders

Hydraulic cylinders with 7- and 8-inch bores for pressures up to 1500 pounds per square inch have been added to the line manufactured by the Hannifin Corporation, 1101 S. Kilbourne Ave., Chicago 24, Ill. These bored and honed cylinders are fitted with automotive type piston rings and interchangeable end caps. Nine standard mounting styles are available with either a standard rod; large 2 to 1 rod; or a double-end rod. 95

Flexible-Shaft Tools

A line of small tools with connections designed for attachment to flexible shafts driven by fractional-horsepower motors is being manufactured by the Speedo Mfg. Co., Inc., 48 W. 48th St., New York 19, N. Y. This new line includes tools for filing, grinding, hammering, and similar operations on precision work.

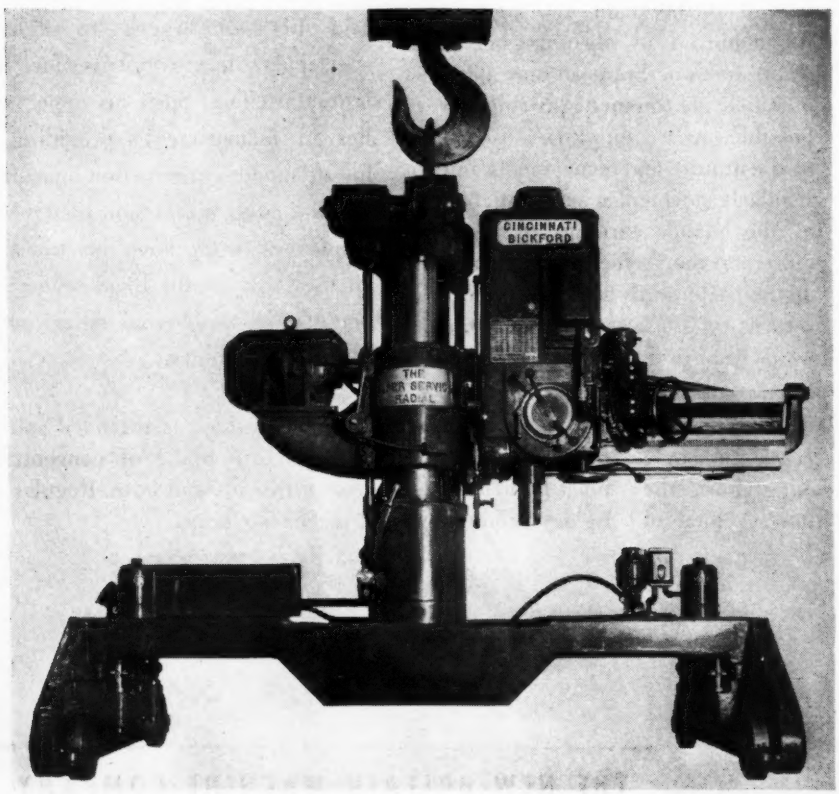
The filing tools are gear-driven, and are used for filing small dies, castings, and patterns for beveling, breaking of sharp edges and corners, slotting, piercing, and removing rough edges after machining operations where ordinary grinders and polishing wheels are not applicable. Quick-change attachments facilitate securing the tool directly to the flexible shaft. These tools operate at speeds of 1000 to 1800 R.P.M., delivering from 500 to 900 strokes per minute. They come in 1/8- and 1/4-inch stroke capacities with two interchangeable collets that hold 3/32- or 1/8-inch shanks. Special Swiss pattern machine and needle files are supplied to fit the hand-pieces, which weigh approximately 4 ounces.



Flexible-shaft Tools Made by Speedo Mfg. Co.

The hand grinder is used largely for grinding, routing, drilling, etc. Its construction embodies hardened and ground shafts, precision ball bearings, and interchangeable collets which hold 3/32- or 1/8-inch shanks. Smaller collets for special purposes are also available. This tool weighs approximately 3 ounces, and can be handled as easily as a pencil. The quick-change device permits convenient and easy changing of tools.

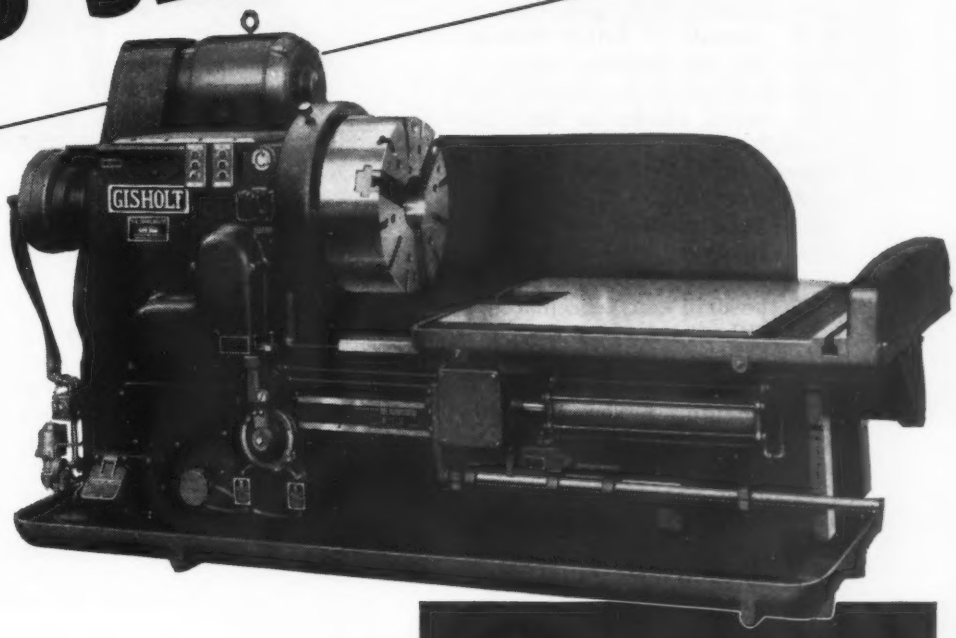
The hammer is a cam-driven instrument used largely for hammering, riveting, and peening delicate work. It is a light, pencil-shaped tool, weighing less than 3 ounces. 96



Cincinnati Bickford Portable Radial Drill

To obtain additional information on equipment described on this page, see lower part of page 226.

RUGGED SIMPLICITY



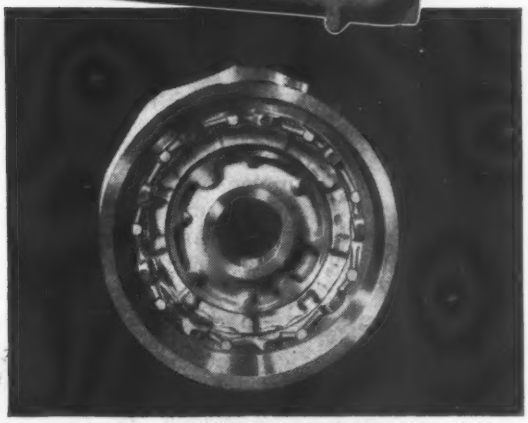
cuts costs on heavy machining jobs

The GISHOLT SIMPLIMATIC

When you put a Simplimatic on the job, you have all the characteristics of an automatic lathe designed solely for that job. Its simple basic design, with the large platen table, permits an endless variety of slide arrangements, assuring the most favorable tooling possible for each job.

Add to this the rugged construction which permits multiple cutting at high speeds, and you have the formula for lower costs on an extremely wide range of heavy turning work. And with completely automatic operation, one man can usually tend two or more machines.

Ask for complete information.



This airplane radial engine crankcase is machined on a Simplimatic. Ten surfaces are machined in 3 minutes and 10 seconds.

Showing arrangement of tooling on Simplimatic for job above. Ten men and ten modern vertical-type turret lathes were formerly required for work now done by one man and two Simplimatics.

GISHOLT MACHINE COMPANY

1209 East Washington Avenue • Madison 3, Wis.

Look Ahead • Keep Ahead • with Gisholt

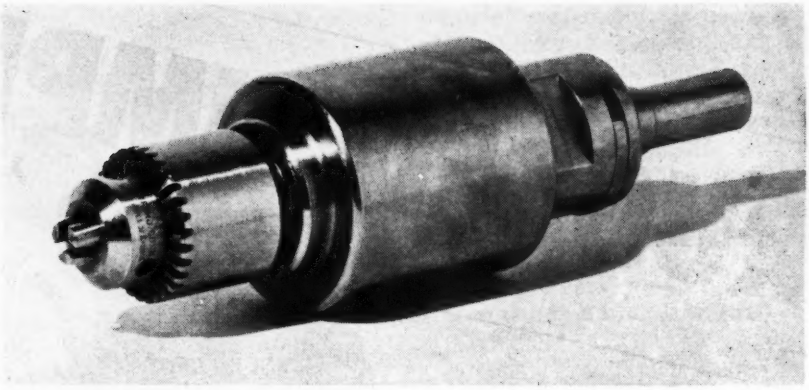
GISHOLT

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

Drilling and Tapping Chuck

A drilling and tapping chuck weighing only 2 pounds and having a maximum capacity for tapping 1/4-inch N.C. and 5/16-inch N. F. threads is being manufactured by the E-Z-Way Mfg. Co., 4200 E. Evans Ave., Denver, Colo. This chuck, known as the "E-Z-Duzit," can be furnished with a Morse No. 1 taper shank or with a 3/8-inch diameter by 1-inch long straight shank which can be used in a chuck attached to a drill spindle. After a drilling operation, the drill can be replaced by a tap without removing the chuck.

In tapping, a stop on the drill press spindle is set for the required depth. When downward movement of the spindle is retarded by the stop, the clutch is disengaged. The tap then ceases to rotate, but the body continues to rotate. Stopping the rotation of the body with a light grip of thumb and forefinger causes the tap to instantly reverse and back out. As soon as the tap is clear of the work, the grip on the body of the chuck is released and the chuck starts to rotate instantly. A slight sweep of the thumb on a latch on the chuck hub while it is rotating will release and engage the clutch. 97



Drilling and Tapping Chuck Made by E-Z-Way Mfg. Co.

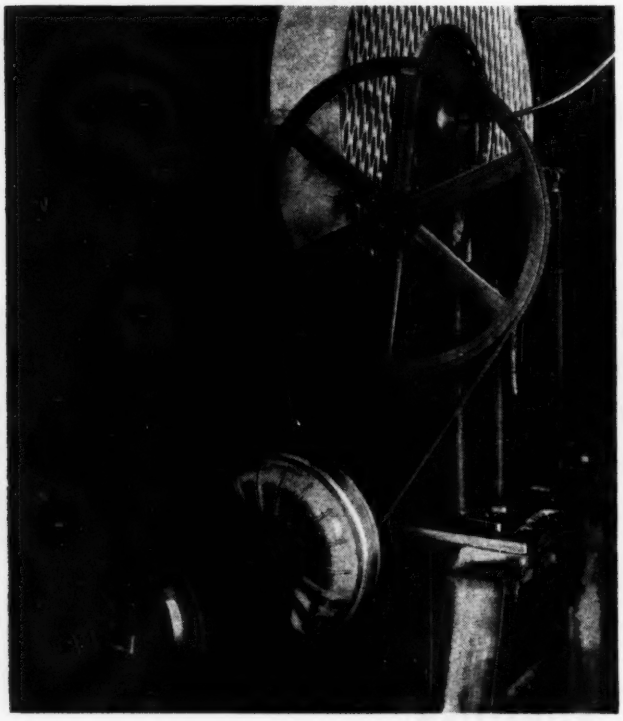
Twin Disc Hydraulic Couplings

A new series of small hydraulic couplings has been introduced by the Twin Disc Clutch Co., Racine, Wis., to supplement its line of larger hydraulic couplings. The new couplings, ranging in size from 7.4 to 12.2 inches, are designed to provide a smoother, more flexible flow of power from internal combustion engines and induction motors developing 1 to 25 H.P. at 1800 R.P.M.

It is claimed that this type of coupling cushions shock loads, thus preventing damage to driving or driven parts; eliminates torsional vibration; starts heavy loads quickly and easily; makes it impossible to stall engine by application of load; and permits selection of motor on the basis of running requirements. 98

Remington Rand Vacuum-Seal Photographic Contact Printer

Remington Rand, Inc., 315 Fourth Ave., New York 10, N. Y., has brought out a new vacuum seal "Portagraph" contact printer having a printing area of 31 by 43 inches. This machine is con-



Twin Disc Hydraulic Coupling Installed between Motor and Driven Mechanism of Industrial Machine

Vacuum-seal Photographic Contact Printer Brought out by Remington Rand, Inc.

To obtain additional information on equipment described on this page, see lower part of page 226.

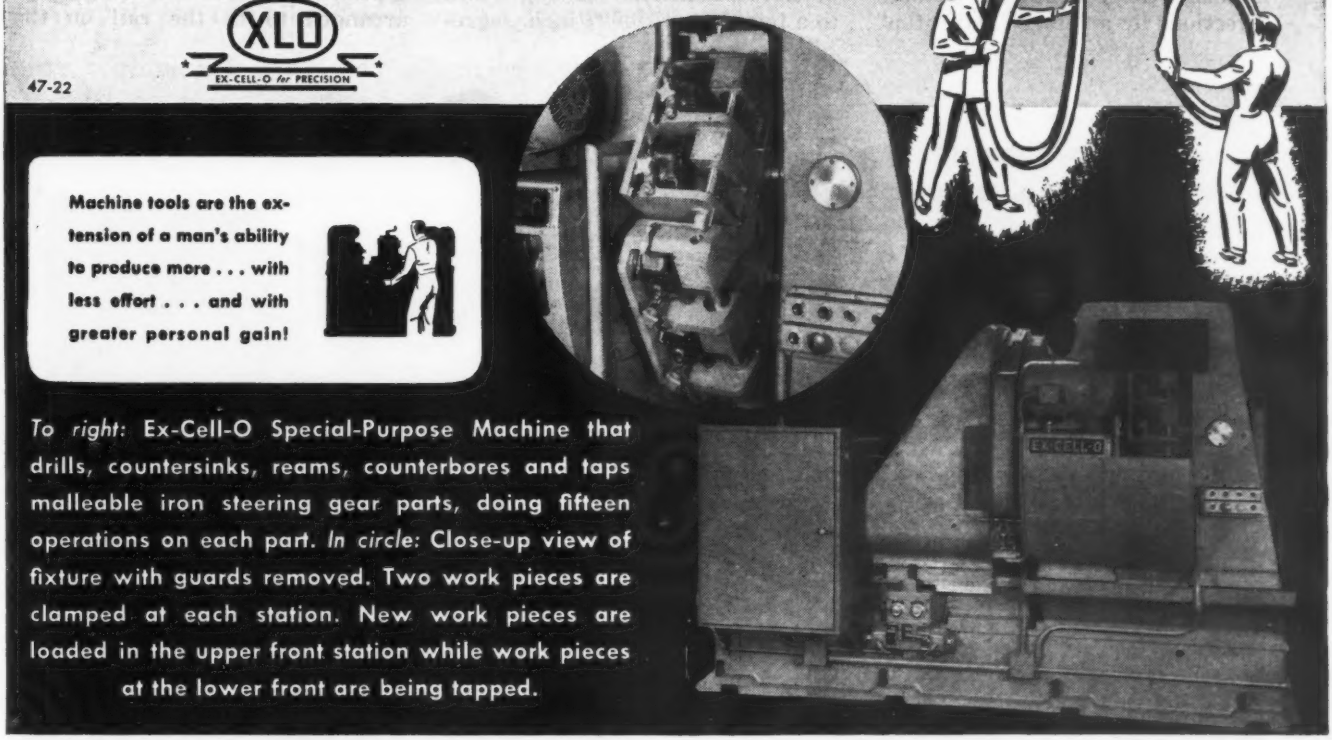
Combine Operations AND CUT PRODUCTION COSTS

Consider an Ex-Cell-O Special-Purpose Machine; It May Prove a Profitable Investment for You!

In many instances, despite high labor costs, production costs can be held down by combining operations and letting automatic machines do more of the work. Combining operations requires less man-hours, less floor space, less handling of parts, and also assures accurate work . . . as the parts are located and clamped only once the different operations are easily held in correct dimensional relationship. Many industries are combining diversified machining operations on Ex-Cell-O Special-Purpose Machines and finding that it pays off in more parts per hour and lower unit cost.

XLO
EX-CELL-O for PRECISION

47-22



Machine tools are the extension of a man's ability to produce more . . . with less effort . . . and with greater personal gain!

To right: Ex-Cell-O Special-Purpose Machine that drills, countersinks, reams, counterbores and taps malleable iron steering gear parts, doing fifteen operations on each part. *In circle:* Close-up view of fixture with guards removed. Two work pieces are clamped at each station. New work pieces are loaded in the upper front station while work pieces at the lower front are being tapped.

EX-CELL-O CORPORATION

DETROIT 6 · MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • CONTINENTAL CUTTING TOOLS • MISCELLANEOUS PRODUCTION PARTS
FUEL INJECTION EQUIPMENT • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • DAIRY EQUIPMENT

structed with a rigid reinforced vacuum top; a vacuum pump creates an effective seal which insures maximum contact between the original and the sensitized paper.

The unit has a storage cabinet and a paper storage drawer. It is equipped with an automatic electric timer; Mazda 25- and 60-watt lamps; a timer light to facilitate dark-room work; and two ruby spotting lights. 99

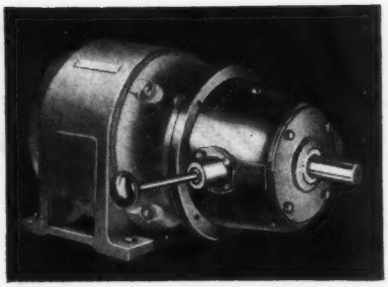
Almco Octagonal Deburring and Finishing Barrels

Almco Inc., 231 E. Clark St., Albert Lea, Minn., has brought out a line of eleven octagonal deburring and finishing barrels 30 inches in diameter which are available in lengths of from 32 to 60 inches with nine standard compartment sizes ranging from 12 to 60 inches in length. The barrels are furnished either plain (unlined) or with a neoprene lining. They are motor-driven at 10, 15, 20, or 30 R.P.M. through a speed reducer and four-step V-belt pulleys, a lever-operated belt release mechanism permitting quick selection of the desired speed. To facilitate positioning the barrel for loading and unloading, provision is made for rotating it in both directions by a "start" and "stop" lever which applies a hydraulic brake in the "stop" position. The compartment doors can be opened and closed by quick-acting toggle clamps. 100

Western Two-Speed Motor Transmission

The Western Mfg. Co., 3400 Scotten Ave., Detroit 10, Mich., has brought out a two-speed motor transmission unit with which direct motor speed, neutral, and reduced speed operation are obtainable through an automotive type gear-shift lever. The unit can be furnished with any one of the standard reductions of 1 1/2 to 1; 2 to 1; 3 to 1; 4 to 1; and 6.25 to 1.

Units manufactured for application on motor frames Nos. 224, 225, and 254 are mounted on flanged type end-shields, and can be swiveled about on the face of the flange to locate the shifting lever in any one of three different positions. The larger sizes of these new two-speed transmissions are made with modified base mountings corresponding with the legs of the motor frame. 101

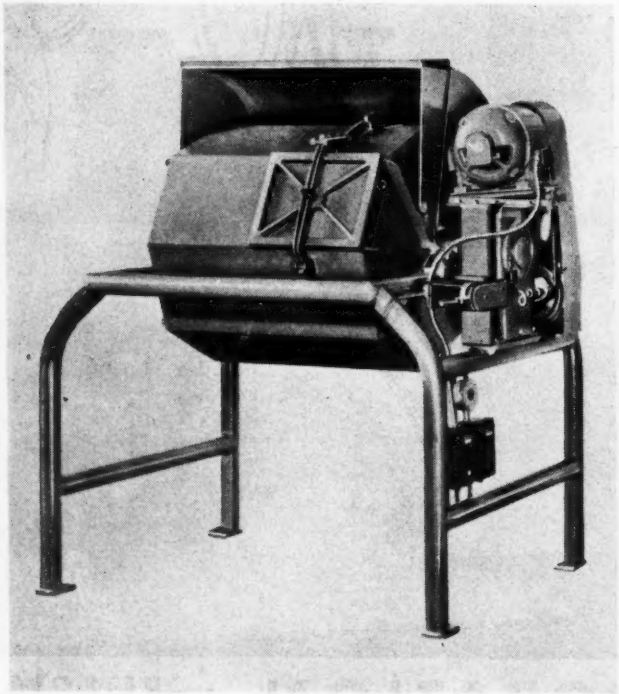


Western Two-speed Transmission Mounted on 5-H.P. Motor

Automatic Piston-Ring Inspecting and Segregating Instrument

A new automatic segregating instrument designed for the rapid and accurate inspection of compression and oil piston-rings has been built by the Sheffield Corporation, Dayton 1, Ohio. This instrument will automatically check the ring thickness to a tolerance of 0.0005 inch and the gap width to a tolerance of 0.007 inch, segregating the rings at the rate of 2400 per hour.

After the instrument has been set up, using piston-rings of known minimum and maximum dimensions as masters, the operator simply places the rings to be inspected in a three-finger stack type holder with the ring gaps arranged to fit the rail on the

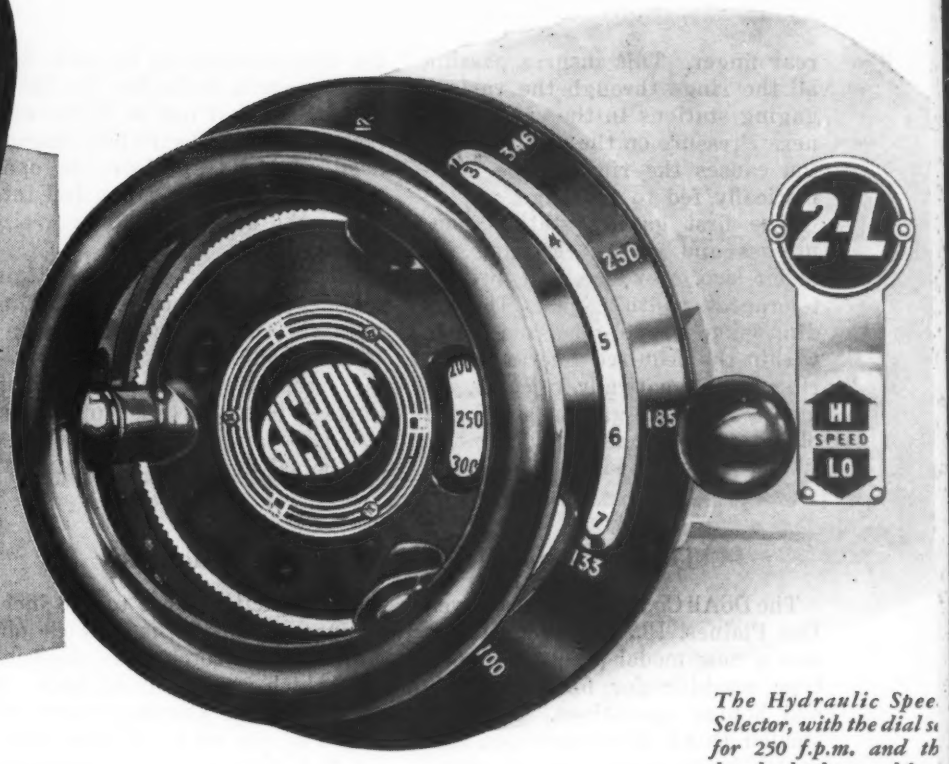


Octagonal Deburring and Finishing Barrel Brought out by Almco Incorporated

Automatic Piston-ring Inspecting Instrument Built by Sheffield Corporation

To obtain additional information on equipment described on this page, see lower part of page 226.

HYDRAULIC SPEED SELECTOR



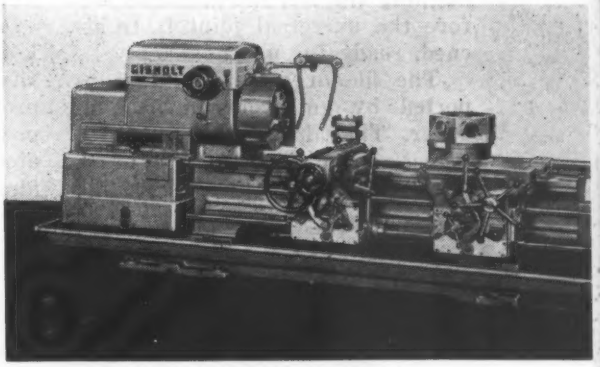
The Hydraulic Spee Selector, with the dial s for 250 f.p.m. and th hand wheel turned for cut of 5¾-inch diamete

Now *Standard Equipment* on Gisholt Turret Lathes!

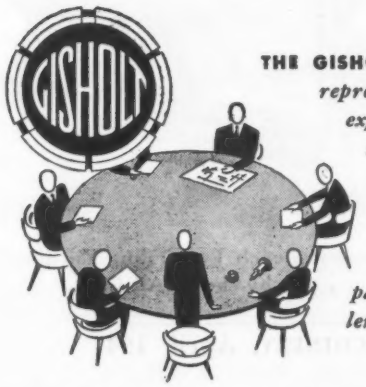
With a Gisholt you can obtain any one of 12 spindle speeds, instantly, without releasing the main drive clutch—without even stopping the spindle!

With the Hydraulic Speed Selector, you don't waste time and effort between cuts. Merely set the dial for the cutting speed you wish, then turn the hand wheel for the proper diameter. You pre-select the speed and diameter for the next cut while this one is being made. And when it's time to change—just tap the trip lever!

Easy? Of course. But more than that, the Gisholt Hydraulic Speed Selector is a big step toward maximum production at rock bottom cost.



GISHOLT 2L HIGH PRODUCTION SADDLE TYPE TURRET LATHE—*Product of a half century devoted to the finest class of metal-working equipment, the Gisholt 2L is designed for the maximum speeds and feeds cutting tools will withstand. Incorporated in its rugged design are a number of simple, power operated controls designed to cut time and effort to a minimum. Write for full details.*



THE GISHOLT ROUND TABLE *represents the collective experience of leading specialists in the machining, surface-finishing, and balancing of round and semi-round parts. Bring your problems here.*

GISHOLT MACHINE COMPANY

1245 E. Washington Ave. • Madison 3, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • BALANCERS • SUPERFINISHERS • SPECIAL MACHINES

rear finger. This insures passing all the rings through the various gaging stations in the same manner. Pressure on the starting button causes the rings to be automatically fed to the gage.

The first gaging station compresses and checks the ring for under size, over size, and "within tolerance width" gap. If the dimension gaged does not come within the required tolerance, the ring is automatically rejected, removed from the gaging slide, and placed in a special compartment. When the gap width is correct, the ring proceeds to the next station, where it is checked for thickness. Should it not be of the correct size, the "Electrichek" gaging head causes trap doors to open through which the rings fall into either the under size or over size compartment.

If all dimensions are within tolerance limits, the piston-ring proceeds through all the gaging stations and down a chute into the receptacle for accepted units. Parts rejected because of undersize gaps and over-size thickness can be salvaged. 102

DoAll Versatile Bench Filing Machine

The DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill., has added to its line a new model precision bench type machine for filing, sawing, and honing operations. Like the smaller DoAll filing machines, this model incorporates the patented universal joint clamp designed to position the file accurately in a vertical position even though the shank is warped or twisted. A file setting square is supplied for aligning the file, hone, or saw before the universal joint is tightened, ready for use.

The file or other tool is supported by an over-arm back-up roller. The tilting table is 10 3/8 inches square. The machine has a stroke of 1 1/2 inches, and a file shank capacity of 1/8 to 3/8 inch. Reciprocation of the tool is obtained by a Scotch yoke mechanism, which runs in an oil bath. A window in the housing shows the height of the oil level. The vertical shaft bearings can be adjusted by thumb-screws on the outside of the housing. An air blast from a neoprene bellows serves to keep chips out of the mechanism and blow them away from the tool and work.

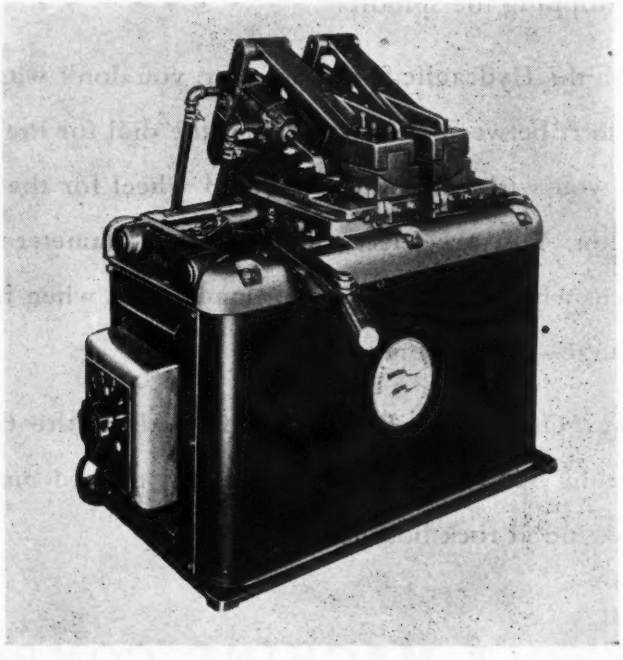
This unit is powered by a 1/4-H.P., 110-volt, 1724-R.P.M. alternating-current motor which provides an operating speed of approximately 350 strokes per minute. Standard equipment includes files, saw, and honing stone.....103

Banner Bench Type Butt-Welder

A compact bench type butt-welder of 10 KVA capacity, manufactured for either 220- or 440-volt, 60-cycle current, is a recent development of the Banner Products Co., 4938 N. 29th St., Milwaukee 9, Wis. The outstanding features of this welder include eight ranges of heat, round steel guides for the movable platen mounted in Oilite bushings, ample grease outlets, and a built-in tap switch. The high-strength bronze head is water-cooled and has good electrical conductivity. The transformer is of the water-cooled type and is provided with an asbestos shield.

Accurate alignment and precision work are assured through the use of air-operated clamping blocks which maintain a constant pressure on material while it is being welded. Welding is started by a covered foot-switch connected to a four-way solenoid air valve which brings the clamps into position. The movable platen is operated by a hand-lever with pilot switch which applies current at the joint, while another hand-lever is pulled toward the stationary platen for the upsetting operation. Current is automatically shut off by an adjustable limit switch. Air-line equipment is regularly included with this machine. 104

Precision Bench Type Filing Machine Built by the DoAll Co.



Bench Type Butt-welder Manufactured by the Banner Products Co.

To obtain additional information on equipment described on this page, see lower part of page 226.

Users of Threadwell COLD-TEMPER Taps know that they're getting more for their money

- more holes per tap because Threadwell's deep-freeze treatment at 120° below zero gives extra hardness with no loss of ductility and *polished flutes* mean reduced chip clogging and breakage
- more convenience in use because Threadwell Taps are *i-dot-ified*, greaseless rust-proofed, tap-capsuled* in transparent plastic tubes to protect ground threads and permit selection without unwrapping.

**Red* dot on the shank for cut thread, *white* dot for commercial ground, *blue* dot for precision ground.

Threadwell Screwplates are designed for maximum utility. They assure quick, clean, straight, accurate threading for every shop purpose.

Threadwell Counterbore Sets give you the sizes you want for fillister screw counterboring or spot facing. Threadwell High Speed Counterbores cut like a drill, without chatter. Two cutting lips with spiral flutes for ample clearance and strength, easy sharpening.

Threadwell Keyway Cutter Sets give you the fastest, simplest, lowest cost means of cutting keyways to standard width and any desired depth. The Threadwell Arbor Press is ideal for use with the Keyway Cutters and for many other purposes around the shop.

Write for Bulletins

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"TAPS OF DISTINCTION"

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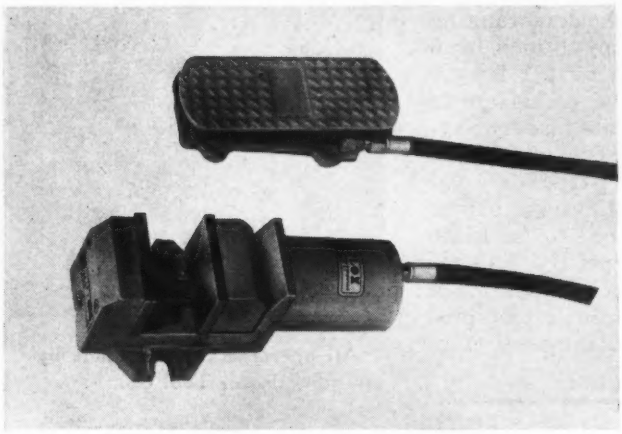
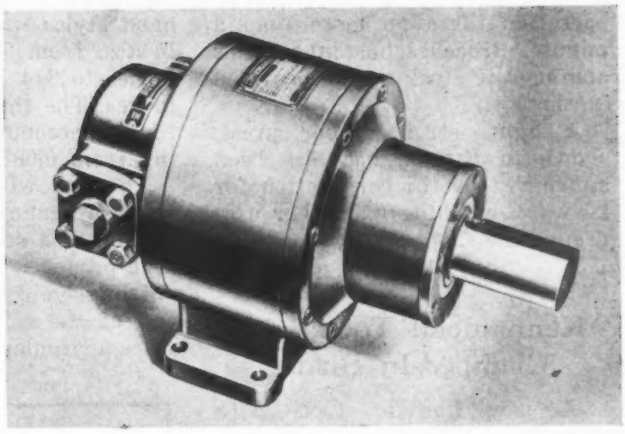
CALIFORNIA OFFICE, THREADWELL TAP & DIE CO. OF CALIF., 1322 SANTA FE AVE., LOS ANGELES 21



Airlox Vise and Latching Type Foot Control Valve



High-pressure Pump Brought out by Superdraulic Corporation

Airlox Vise Kit

A new Airlox vise kit, consisting of an air vise, a 5-foot length of air hose, and a latching type foot-valve, has been placed on the market by Production Devices Inc., Whitehall, N. Y. This air vise is operated by a leather cup piston assembly, and has a movable jaw stroke which is adjustable up to 1/4 inch at any position within the maximum 2-inch opening range. By removing the jaw-stroke limit screw, the full 2-inch stroke can be obtained when desired. However, it is recommended that the vise be used with the stroke limit screw in place.

The vise has an over-all length of 10 1/2 inches, is 5 inches wide, and has an over-all height of 3 1/2 inches. The jaw width is 3 inches and the depth 2 inches. The gripping force on the work is five times that of the pressure in the air line. The vise weighs approximately 19 pounds, and the total weight of the kit is about 24 pounds. 105

Superdraulic High-Pressure Pump

A hydraulic pump developing pressures up to 5000 pounds per square inch, yet small enough and light enough for easy handling, has been brought out by the Superdraulic Corporation, Miller at Ford Road, Dearborn, Mich. This new "Superdraulic Junior" hydraulic pump is practically a reduced-scale duplicate of the Superdraulic 40-H.P. constant-delivery pump. It is only 6 inches in diameter, 11 inches long, and weighs approximately 35 pounds. The single bank of plungers delivers 3 gallons per minute at 1800 R.P.M., and 2 gallons per minute at 1200 R.P.M. 106

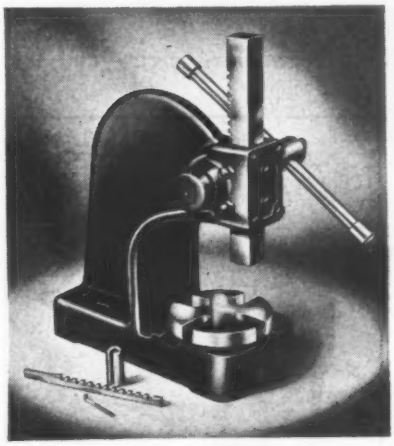


Fig. 2. Hand-operated Arbor Press for Use with Broach Kit in Fig. 1

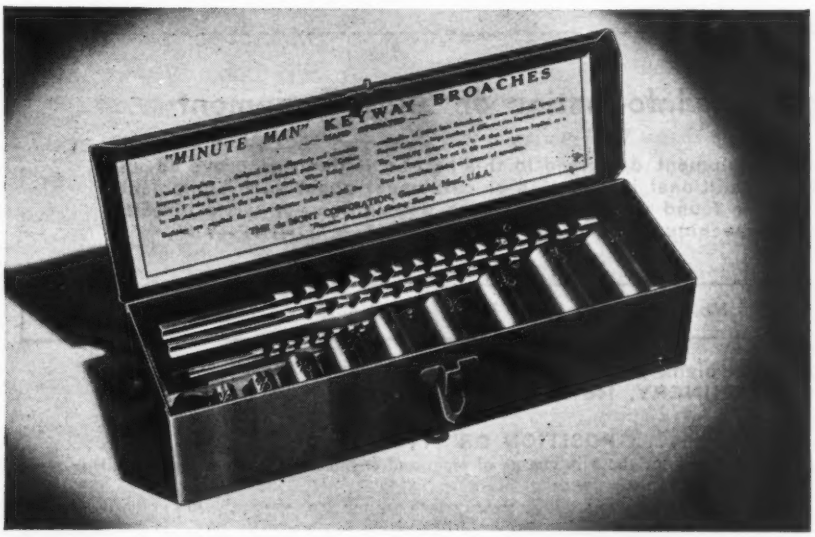


Fig. 1. Keyway Broach Kit Placed on the Market by the du Mont Corporation

Keyway Broaches and Arbor Press

The du Mont Corporation, Greenfield, Mass., has placed on the market a "Minute Man" keyway broach kit (Fig. 1), comprising broaches for hand cutting keyways of any standard width and any depth in gears, milling cutters, pulley hubs, collars, couplings, and many other parts. These broaches are used with a hand-operated arbor press, the proper size bushing for any given bore being selected from the kit and dropped into the bore. A broach of the desired width is inserted in a slot in the bushing and pressed through the work with the arbor press, using shims and a second pass to get the exact keyway depth desired. The entire

To obtain additional information on equipment described on this page, see lower part of page 226.

operation takes no more than a minute. Broaches, bushings, shims and keyway stock are all provided in the kit.

A light, strong arbor press, shown in Fig. 2, has also been announced by the corporation for keyway broaching and other uses around the shop. 107

Kennametal Tools with Clamped-In Blades

A new line of tools with clamped-in Kennametal blades or cutters has been announced by Kennametal Inc., Latrobe, Pa. The grooving and cut-off tool, Fig. 1, having a solid Kennametal blade which can be advanced after each resharpening until about half its length has been utilized, is adapted for single grooving or cutting-off operations such as are performed on turret lathes. This tool is made in five standard right- and left-hand styles with holders ranging in size from 3/4 by 1 inch by 6 inches to 3/4 inch by 1 1/2 by 9 inches. The three sized holders in the line accommodate blades ranging from 0.08 to 0.25 inch thick.

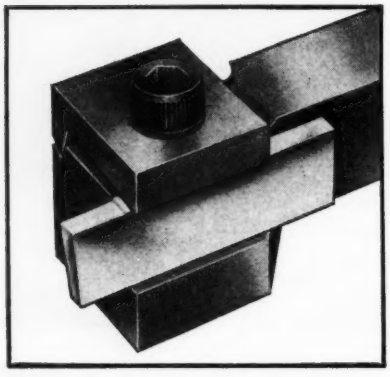


Fig. 1. Grooving and Cutting-off Tool with Solid Kennametal Clamped-in Blade

The tool with clamped-in solid round Kennametal inserts shown in Fig. 2 is designed to facilitate high-production repetitive jobs requiring complex tool set-ups. Each end of the solid round tool provides a circular cutting edge. Only a small section of this edge, depending upon the depth of cut, bears against the work, and when this section becomes dull, the clamping screw is loosened, and the tool is revolved around its axis to provide a new cutting edge, after which the clamping screw is retightened.

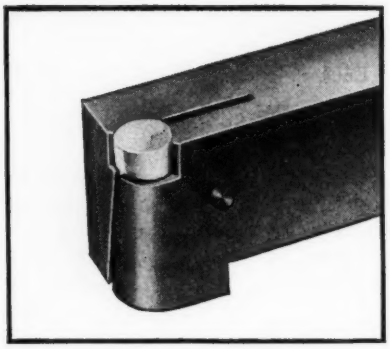
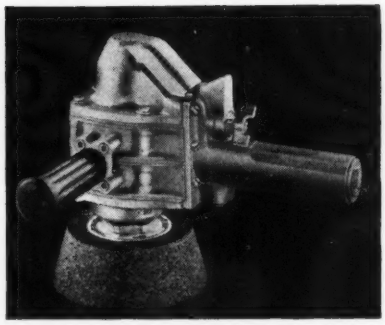


Fig. 2. Tool with Clamped-in Solid Kennametal Round Insert

This tool is made in right- and left-hand styles with holders in three sizes having Kennametal round inserts 3/8 inch in diameter by 3/4 inch long, and 1/2 inch in diameter by 1 inch long.....108



Air-operated Grinder Made by Rotor Tool Co.

Rotor Vertical Air-Operated Grinder

The Rotor Tool Co., Cleveland, Ohio, has announced a vertical type air-operated grinder which is equipped with a 6-inch cup-wheel. The new grinder has a speed range of 3500 to 5500 R.P.M., and is adapted for grinding small castings requiring a smooth, flat finish. It is useful in leveling off welds and removing gates or fins.

This tool can also be had with 9-inch sanding pads for finishing sheet metal, smoothing up electric welds, and general sheet-metal fabrication on such work as automobile bodies, refrigerators, etc., at speeds of 4500 to 5000 R.P.M.

When equipped with a 6-inch cup-shaped wire brush, this vertical type tool can be used at a speed of 3500 R.P.M. for such operations as smoothing paint; cleaning scale from electric welds; and removing burrs and sand from castings. The tool weighs 12 1/2 pounds, and is only 8 1/8 inches high. 109

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described in this section is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning machine as described in April, 1947, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on blank below. Detach and mail within three months of the date of this issue to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

NAME.....**POSITION OR TITLE**.....

[This service is for those in charge of shop and engineering work in manufacturing plants.]

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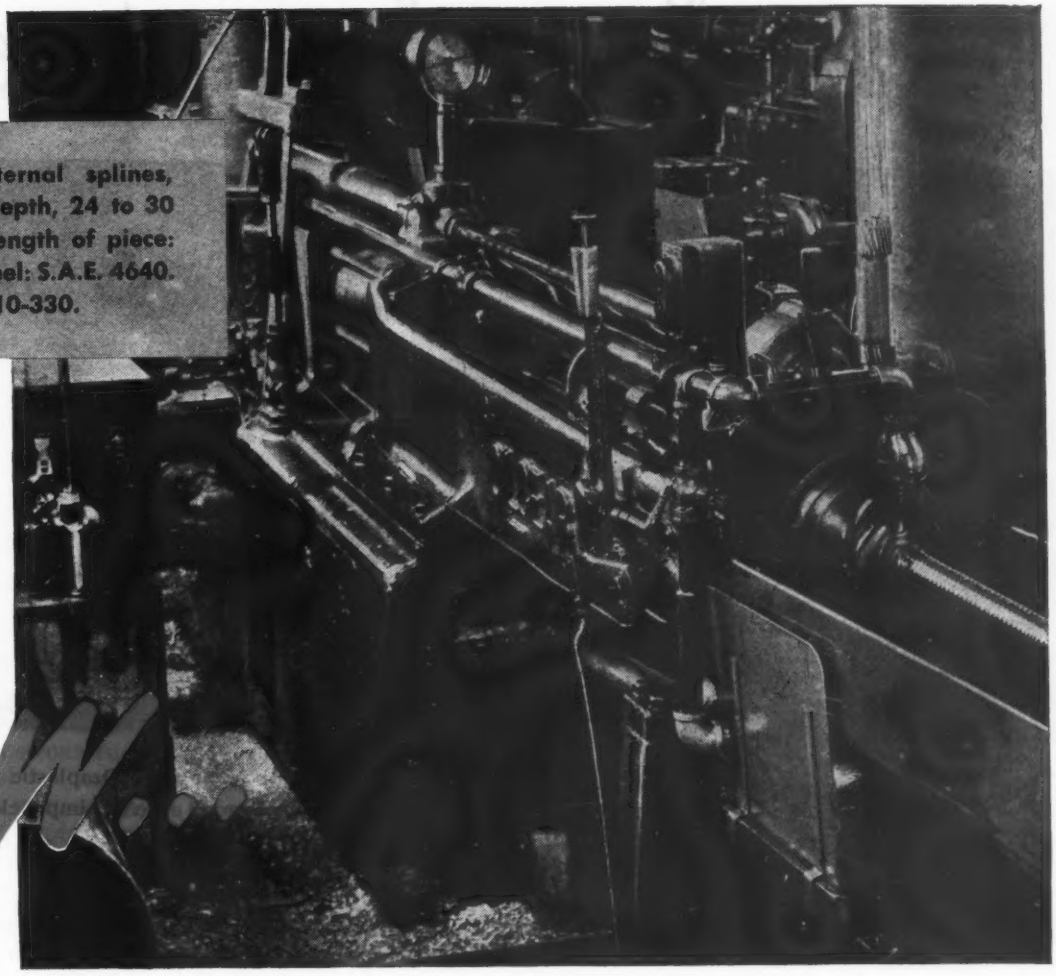


THE JOB: Cutting internal splines, 3/16" to 1/4" in depth, 24 to 30 splines per piece. Length of piece: 6". Diameter: 2". Steel: S.A.E. 4640. Brinell Hardness: 310-330.

NOW...

BROACHES LAST 50% LONGER

THIS job offers a good example of how Texaco Products and Lubrication Engineering Service are helping industry everywhere improve products and reduce costs.

With the competitive cutting oil previously used, frequent re-grinding of broaches was necessary and great difficulty was encountered in maintaining size. On the recommendation of a Texaco Lubrication Engineer, *Sultex Cutting Oil B* was adopted. *Broach life immediately increased 50% and size difficulties were eliminated.*

Texaco Sultex Cutting Oil B is one of a whole family of Texaco cutting coolants designed to help machine all metals better, faster, at lower cost. These famous oils cool as they lubricate . . . prevent chip welding and wheel loading . . . assure more cuts per tool grind and improved finish . . . reduce rejects.

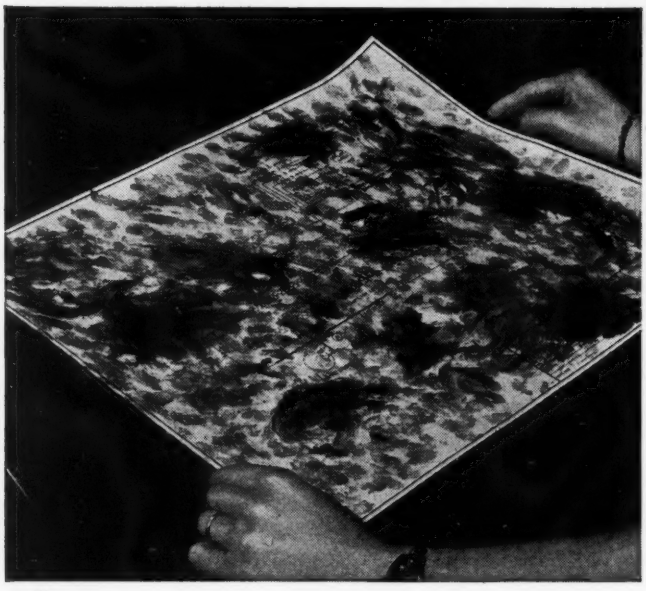
Call on Texaco Lubrication Engineering Service for assistance in selecting and using the right lubricants to give you these cost-saving benefits. Contact the nearest of the more than 2300 Texaco distributing plants in the 48 States, or write The Texas Company, 135 E. 42nd St., N. Y. 17, N. Y.

TEXACO

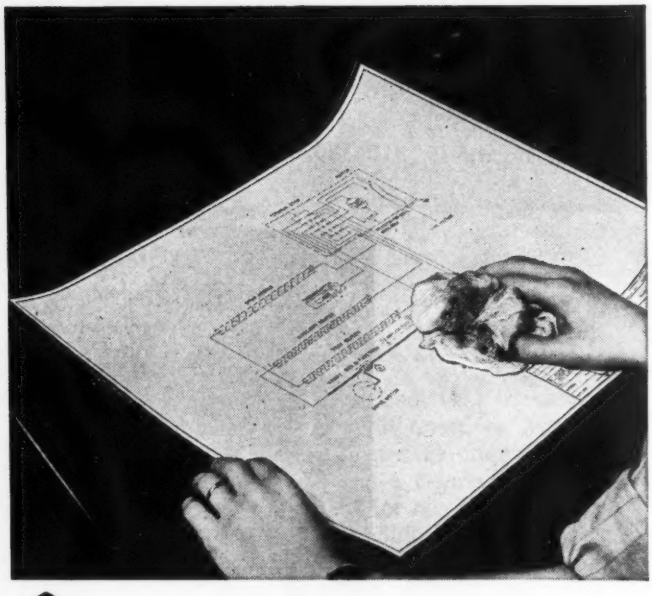
TEXACO CUTTING, SOLUBLE AND GRINDING OILS FOR FASTER MACHINING

Tune in . . . TEXACO STAR THEATRE presents the NEW TONY MARTIN SHOW every Sunday night. See newspaper for time and station.

The worst "beating" any print ever took!



Immersed in water for 72 hours! Then oil was poured over it... and, just before this picture was taken, it was smeared with heavy grease!



Here is the same Ozaplastic print seconds later! ... As good as ever, simply cleaned with a damp cloth!

OZAPLASTIC eliminates 95% of your print replacement costs . . . is recommended whenever the going is tough ...where standard paper or cloth prints "fold up" after a short period of service.

You'll want to use Ozaplastic in the shop and field... around operations where grease, grime, or water abound ...where precision is of the utmost importance...where annoyances—such as having to wait for a new print—put a hitch in production.

When soiled, you need only rub a damp cloth over Ozaplastic and it's like new—all details sharp and clear, *jet black* on a glossy white background.

For this reason, OZAPLASTIC is also used in sales catalogs and presentation booklets—even laminated on machines, etc., when "on-the-spot" instructions or wiring diagrams are required.

Now . . . Make 16 Types of Ozalid Prints!

OZAPLASTIC is only one of the 16 different types of prints you can produce in an Ozalid machine.

For example, you can reproduce the lines and images of any translucent original in black, blue, red, sepia, or yellow colors. And make prints on white or tinted paper, cloth, foil, film, or plastic.

Thus, you can "color code" prints of different operations . . . and always match the print to the job at hand.

Furthermore, all of these Ozalid prints are made in exactly the same manner—without interruption—in 30 seconds or less.

See the 16 different types of Ozalid prints. Learn how economical it is to make them in the new OZALID STREAMLINER.

Write today for free booklet No. 256.

OZALID

DIVISION OF GENERAL ANILINE AND FILM CORPORATION

JOHNSON CITY, NEW YORK

Ozalid in Canada—Hughes Owens Co., Ltd., Montreal

New Trade Literature

RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

To Obtain Copies, Fill in on Form at Bottom of Page 230 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the April, 1947, Number of MACHINERY

Boring, Reaming, and Milling Tools

KELLY REAMER CO., Cleveland 1, Ohio. Catalogue TS, describing the Kelly complete line of boring, reaming, and milling tools for production work. The construction of each type of tool is illustrated and described, and various applications are shown. Typical examples of special tools designed for particular jobs are also shown. Complete specifications are included.....1

Powdered-Metal Parts and Bearings

KEYSTONE CARBON CO., INC., St. Marys, Pa. Catalogue on powdered-metal parts and bearings, listing many new sizes of self-lubricating porous bronze bearings. Examples of a variety of powdered-metal parts are shown by line illustrations, and engineering data is included. 2

Castings

HOWARD FOUNDRY CO., 1701 N. Kostner Ave., Chicago 39, Ill. Circular illustrating operations in the production of aluminum, magnesium, bronze, and semi-steel castings, as well as examples of some of the complicated shapes produced. Technical information and specifications are included...3

Aluminum Castings

GENERAL ALUMINUM MFG. CO., 3027 E. 55th St., Cleveland 4, Ohio. Catalogue on aluminum permanent-mold and sand castings, showing typical examples of work produced and giving tables of composition and properties of interest to designers and users...4

Ball Bearings for Precision Instruments

MINIATURE PRECISION BEARINGS, INC., Keene, N. H. Bulletin containing data on five types of miniature ball bearings for precision instruments and mechanisms. Recommended load ratings for typical requirements are included. 5

Welding Procedures for Iron

AMPCO METAL, INC., 1745 S. 38th St., Milwaukee 4, Wis. Procedure Sheets describing recommended practice in welding malleable and cast iron, including type of electrode to be used, preparation of work, preheating, and welding procedure. 6

Bearing Bronze

JOHNSON BRONZE CO., 520 S. Mill St., New Castle, Pa. Catalogue 460, containing eighty pages of data on Johnson bronze bushings and bearings, as well as bar bronze and babbitt, all of which are available for immediate delivery. 7

Stiffness Gage

TABER INSTRUMENT CORPORATION, 111-M Goundry St., North Tonawanda, N. Y. Bulletin describing a precision stiffness gage designed for the laboratory testing of light sheet metal, laminated plastics, paper, and other flexible materials up to 1/8 inch thick.....8

Induction Motors

RELIANCE ELECTRIC & ENGINEERING CO., 1077 Ivanhoe Road, Cleveland 10, Ohio. Bulletin C-118, on Reliance protected open type frame squirrel-cage induction motors. Bulletin C-125, on totally enclosed, fan-cooled squirrel-cage induction motors. 9

Gear Lappers and Gear Speeders

MICHIGAN TOOL CO., 7171 E. McNichols Road, Detroit 12, Mich. Bulletins 995 and 1127, covering, respectively, Michigan crossed-axis production gear-lapping machines and "Sine-Line" gear speeders. 10

Meehanite Casting Applications

MEEHANITE METAL CORPORATION, Pershing Square Bldg., New Rochelle, N. Y. Bulletin 24—first of a series containing information on the latest developments in engineering applications of Meehanite castings. 11

Infra-Red Industrial Heating Equipment

FOSTORIA PRESSED STEEL CORPORATION, Fostoria, Ohio. Circular entitled "Infra-Red Parade," showing various applications of the infra-red heating process for baking, drying, preheating, dehydrating, etc. 12

Metal-Cutting Process

CINCINNATI MILLING AND GRINDING MACHINES, INC., Cincinnati 9, Ohio. Bulletin containing a reprint of an article on "Mechanics of the Metal-Cutting Process," published in the *Journal of Applied Physics.* 13

Caster Manual

RAPIDS-STANDARD CO., INC., Department C-137, 308 Peoples National Bank Bldg., Grand Rapids 2,

Mich. Catalogue 65-3, containing 44 pages of technical data and general information on industrial steel-forged casters. 14

Beam Compass for Shop and Drafting-Room

NIAGARA INSTRUMENT CORPORATION, 58 Market St., Lockport, N. Y. Folder descriptive of the new Bartusch beam compass with rack and gear control for metal scribing and drawing. 15

Portable Electric Tool

PRECISE PRODUCTS CO., Racine 1, Wis. Folder illustrating and describing the "Precise 40," a light-weight electric hand tool and portable grinder operating at speeds up to 40,000 R.P.M. 16

Ampco Metal in Machine Tools

AMPCO METAL, INC., 1745 S. 38th St., Milwaukee 4, Wis. Bulletin 57A, entitled "Ampco Metal in Machine Tools," listing a wide range of machine tool parts made of this aluminum-bronze alloy...17

Permanent-Magnet Separators

HOMER MFG. CO., INC., 436 N. Main St., Lima, Ohio. Folder on Homer permanent-magnet separators for eliminating iron and steel particles during manufacturing or processing operations. 18

Swiss Files

GROBET FILE CO. OF AMERICA, 421 Canal St., New York 13, N. Y. Booklet listing over 3000 different patterns and sizes of hand and machine files and rifflers, as well as rotary and deburring files and countersinks. 19

Machine Tool Clutches

CARLYLE JOHNSON MACHINE CO., Manchester, Conn. Installation and Data Book No. 47, containing complete engineering data on the Maxitorq floating-disk clutch and the Maxitorq automatic overload release clutch. 20

Power-Drive Flexible Shafts

F. W. STEWART MFG. CORPORATION, 4311-13 Ravenswood Ave., Chicago 13, Ill. Bulletin on the new power-drive "Circle Ess" flexible shafting for polishing, sanding, buffing, and drilling metal, plastics, or wood. 21

Electronic Control

W. C. ROBINETTE CO., 802 Fair Oaks Ave., South Pasadena, Calif. Bulletin H-26, illustrating and describing the "Motron," an electronic "Servomechanism" for the automatic control of a large variety of operations. 22

Solderless Wiring

AIRCRAFT - MARINE PRODUCTS, INC., 1582 N. Fourth St., Harrisburg, Pa. Selection data book for design and production engineers, covering this company's line of solderless wiring devices. 23

Pyrometers

ILLINOIS TESTING LABORATORIES, INC., 420 N. La Salle St., Chicago 10, Ill. Bulletin 4361, descriptive of Alnor pyrometers designed to withstand severe service. 24

Air-Operated Drop-Hammers

CHAMBERSBURG ENGINEERING CO., Chambersburg, Pa. Bulletin 2-L-6, illustrating and describing "Cecostamp" air-operated drop-hammers for forming a wide variety of metal shapes. 25

Screens for Optical Comparators

JONES & LAMSON MACHINE CO., Springfield, Vt. Catalogue of standard glass screens for all models of Jones & Lamson optical comparators. 26

Universal Tool and Cutter Grinders

OLIVER INSTRUMENT CO., 1410 E. Maumee St., Adrian, Mich. Catalogue illustrating and describing the Oliver "Ace" universal tool and cutter grinder. 27

Magnetic Crane Control

WESTINGHOUSE ELECTRIC CORPORATION, Pittsburgh 30, Pa. Booklet covering five types of alternating-current magnetic crane controls for handling any type of load. 28

Flexible Couplings

INDUSTRIAL MACHINE WORKS, INC., 21 Winter St., South Hanover, Mass. Circular giving complete specifications for IMW high-torque gear-tooth flexible couplings. 29

Blind Rivets

B. F. GOODRICH CO., Akron, Ohio. "Rivnut Data Book," containing complete information on the "Rivnut," a one-piece blind

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To Obtain Copies of New Trade Literature

listed in this section (without charge or obligation) fill in below the publications wanted using the identifying number at the end of each descriptive paragraph; detach and mail within three months of the date of this issue (April, 1947) to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

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"Standards"
Finish-Ground . . . *ready to go.*

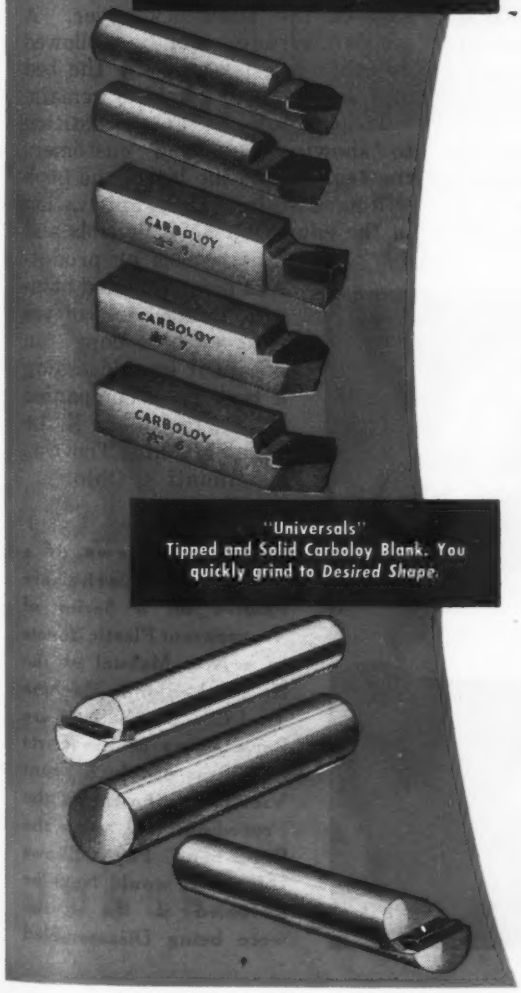
STEP UP ALL YOUR SMALL BORING JOBS

With these Standard CARBOLOY boring tools

★ **FOR ECONOMY**

★ **FOR PRECISION**

★ **FOR CONVENIENCE**



"Universals"
Tipped and Solid Carboloy Blank. You quickly grind to *Desired Shape.*

—put these Carboloy Tools to work on all your small boring jobs. Complete standard line of Carboloy-tipped finish-ground boring tools covers a wide range of standard boring jobs. When special shapes are required, use one of the two "universal" styles—quickly ground to finish shape.

Carboloy-tipped finish-ground boring tools are designed to fit standard boring bars. They are available in both square and round shanks, and in a wide variety of styles and sizes to cover a broad range of applications. Other standards also available for large boring jobs. Stocked for fast delivery coast-to-coast at 70 Carboloy distributors. Call your nearest distributor today. Carboloy Co., Inc., 11147 E. Eight Mile Street, Detroit 32, Mich.

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(TRADEMARK) CEMENTED CARBIDE

AUTHORIZED CARBOLOY DISTRIBUTORS

fastener which can be used as a blind rivet or a nut plate. 30

Horizontal Boring Machines

BARRETT MACHINE TOOL CO., Meadville, Pa. Catalogue B-2000, descriptive of the specialized horizontal boring machines made by the company, including illustrations of typical machines. 31

Bench Drill Presses

ELECTRO-MECHANO CO., 261 E. Erie St., Milwaukee 2, Wis. Pamphlet entitled "Do Your Drilling with the 'Speed-Right,'" descriptive of this company's 8-inch precision bench drill press line.....32

Belts and Sheaves

B. F. GOODRICH CO., Akron, Ohio. Catalogue Section 2170, on Goodrich multi V-belts. Catalogue Section 2175, descriptive of "Magic-Grip" sheaves for use with multi V-belts. 33

Hydraulic Pallet Lift-Trucks

LYON - RAYMOND CORPORATION, Greene, N. Y. Bulletin 221, illustrating and describing a new light-weight hydraulic pallet lift-truck. 34

Rebuilt Machine Tools

MILES MACHINERY CO., Saginaw, Mich. Catalogue 185, listing various types of rebuilt machine tools, most of which are available for immediate delivery. 35

Electric Soldering Tool

IDEAL INDUSTRIES, INC., 1011 Park Ave., Sycamore, Ill. Circular descriptive of the improved "Thermo-Grip" electric soldering set. 36

New and Rebuilt Machinery

J. L. LUCAS & SON, INC., Bridgeport 5, Conn. Circular listing available new and rebuilt machine tools. 37

Oil-Filtration Equipment

BRIGGS FILTRATION CO., Bethesda 14, Md. Catalogue on Briggs standard refills for lubricating oil filters. 38

* * *

Quality Control Course

An eight-day course in quality control by statistical methods has been announced by Purdue University. This course, which will be given from June 27 to July 5, inclusive, is intended for those who already have some knowledge of statistical quality control.

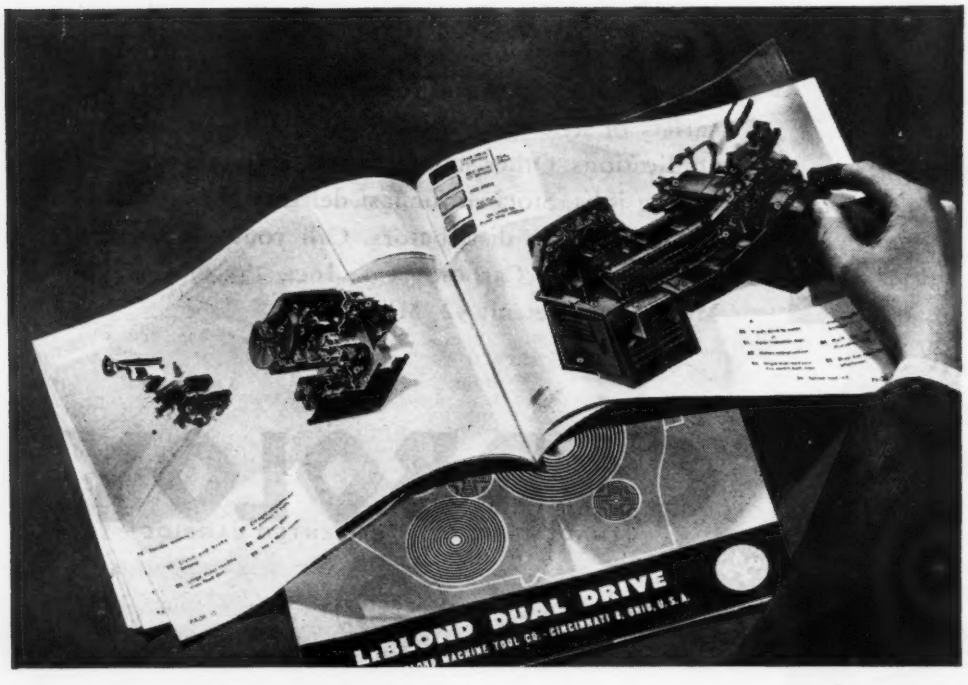
The subject matter of the course will include background of control charts; significance of differences; analysis of variance; linear and multiple correlation; sequential analysis and other sampling; and use of calculating machines. Further information can be obtained by writing I. W. Burr, Purdue University, Lafayette, Ind.

Unique Lathe Manual with Transparent Plastic Sheets

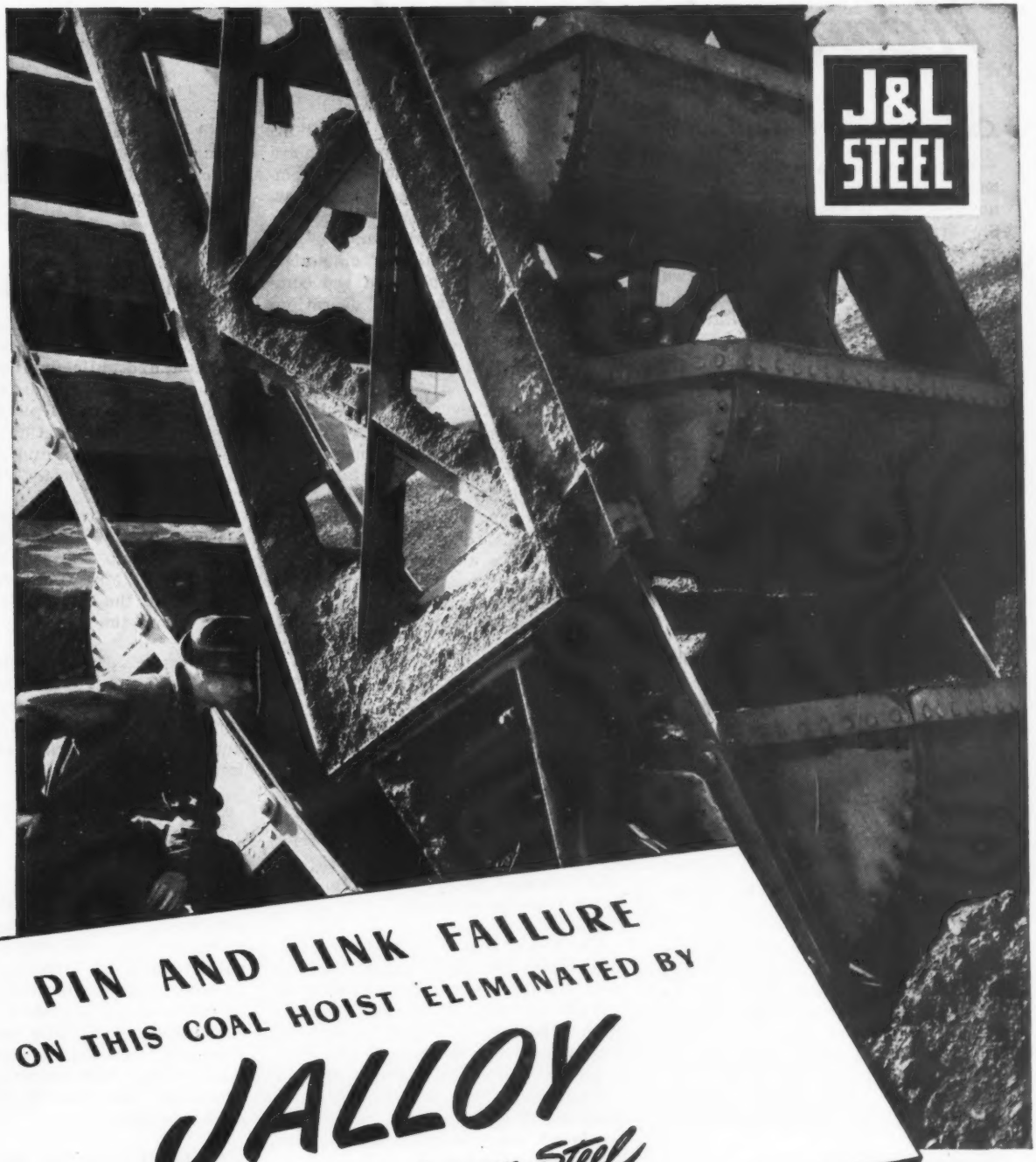
A new manual recently prepared by the R. K. LeBlond Machine Tool Co. to illustrate its dual-drive lathe represents a distinct departure in trade literature. The unique feature of the book is that it is printed on transparent plastic sheets and arranged so that the reader disassembles the machine as he turns the pages. This new technique virtually "X-rays" the lathe in three dimensions, and thereby presents a much clearer conception of its design and construction features than is possible with the usual type of illustrations.

Various sections of the lathe are shown in a series of five sheets. On page 5, is a drawing of the headstock cover and the speed and feed levers mounted on it; in the background, the other lathe parts can be seen through the plastic. As the page is turned, the cover is removed and that portion of the drive that was last assembled is exposed. On the back of the preceding page can be seen the under side of the headstock cover. A similar arrangement is followed on other pages until only the bed and base of the machine remain.

It is expected that, in addition to showing potential customers the features of the lathe, the book will have an important application in the education field. Schools and universities or production personnel and manufacturing executives who wish a copy can obtain it by addressing a request, accompanied by $1, to the R. K. Le Blond Machine Tool Co., Cincinnati 8, Ohio.



Sectional Views of a Dual-drive Lathe are Printed on a Series of Transparent Plastic Sheets in a New Manual of the R. K. LeBlond Machine Tool Co. On the Left are Back Views of the Parts and Units of which Front Views are Shown on the Preceding Page, while the Right-hand Page Shows Units that would Next be Revealed if the Lathe were being Disassembled



PIN AND LINK FAILURE ON THIS COAL HOIST ELIMINATED BY JALLOY

The Tank Armor Steel

Maintenance on the coal hoist above was a constant problem because of repeated failure of the links and pins on the bucket conveyor. All pins and links were replaced with new ones made of Jalloy, the special J&L steel made for tough jobs involving heavy impacts and dynamic stresses. Since then down-time because of pin and link failures has been eliminated—costly maintenance work has been avoided. Write for information about Jalloy steel.

JONES & LAUGHLIN STEEL CORPORATION

PITTSBURGH 30, PENNSYLVANIA

News of the Industry

California and Oregon

ERMAC CO., LOS ANGELES, CALIF., machine tool distributing firm, announces that it has moved from 5531 S. Vermont Ave. to new and larger quarters at 1426 S. Santa Fe Ave., Zone 21. The company, which was previously a partnership, has recently been incorporated, with EDWIN J. RAY and FRANK X. BALE, the original partners, continuing as president and secretary-treasurer, respectively.

LEO A. CARTER, for sixteen years a member of the engineering and manufacturing divisions of the Douglas Aircraft Co., Santa Monica, Calif., has been made manager of the parent plant, succeeding G. A. HUGGINS.

AL SEEDORFF, 10990 Wilshire Blvd., Los Angeles 24, Calif., has been appointed exclusive representative in the state of California for the Progressive Welder Co., 3050 E. Outer Drive, Detroit 12, Mich.

J. G. BOLLINGER has been appointed district sales manager of Air Reduction, 60 E. 42nd St., New York 17, N. Y., with headquarters at 1485 Park Ave., Emeryville, Calif.

MARION B. SAWYER has joined the Bardco Mfg. & Sales Co., Los Angeles, Calif., and will have charge of special motor development and sales.

JAMES P. BATES has been appointed chief metallurgist for the Hyster Co., Portland, Ore. He will be in charge of materials specifications and heat-treating for the company's three plants—Portland, Ore., and Peoria and Danville, Ill.

Illinois

HYDRO-LINE MFG. CO. has recently been formed in Rockford, Ill., to manufacture a complete line of air and hydraulic cylinders, as well as special cylinders of both types. The concern will also engage in the design and manufacture of special machinery and equipment. The plant and offices are located at 711 Nineteenth St., Rockford. G. A. MARKUSON is president; GUST J. PETERSON, vice-president; and H. W. JOHNSON, secretary of the new company. All these men were formerly associated with the John S. Barnes Corporation of Rockford.

ACCURATE SPRING MFG. CO. announces that manufacturing operations have been resumed at 1474 W. Hubbard St., Chicago 22, Ill., following the fire that destroyed its main plant on March 3. Some of the company's output of springs, wire forms, and stampings will be produced by the company's own personnel in the factories of other Chicago companies. The Fowler, Ind., plant of the company continues normal operation. Contracts have been let for the construction of a new fireproof building at the site of the old plant.

YODER CO., Cleveland, Ohio, manufacturer of electric weld tube and pipe mills, cold-roll forming machines, and other sheet-metal working equipment, is opening a new sales and engineering consultation office in the Civic Opera Bldg., 20 N. Wacker Drive, Chicago 6, Ill. THEO. K. ECKHARDT, for thirteen years in the engineering and sales department of the company, will be in charge of the new office.

WHEELCO INSTRUMENTS CO., Chicago, Ill., has recently made an arrangement with ETHER, LTD., of Birmingham, England, to manufacture and market throughout the United Kingdom the Wheelco line of electronic instruments for the measurement and control of industrial processes. The instruments will be sold abroad under the name of Ether-Wheelco controls.

HANNIFIN MFG. CO., Chicago, Ill., announces that the organization has been changed to a corporation to be known as the HANNIFIN CORPORATION. The general offices have been moved from 621 S. Kolmar Ave. into a newly completed addition to the main plant at 1101 S. Kilbourne Ave. ELLWOOD G. PETERSON, formerly vice-president and general manager, has been elected president.

AMGEARS, INC., 6633 W. 65th St., Chicago, Ill., manufacturers of industrial and precision gears and sprockets, announce the appointment of the following district representatives: G. E. MERKLE, 2508 E. Belleview Place, Milwaukee, Wis., and C. S. PRYOR CO., 1645 Hennepin Ave., Minneapolis, Minn.

EDWARD F. DYKSTRA, formerly of the Standard Safety Equipment Co., Chicago, Ill., has been appointed advertising and sales promotion manager of the D. A. Stuart Oil Co., Chicago, manufacturer of cutting fluids and lubricants.

JOHN R. MCGUIRE has been appointed sales manager of the Waterman Engineering Co., Evanston, Ill. He was previously in charge of the sale of hydraulic equipment for the company in the Chicago area.

Indiana and Missouri

CLINTON MACHINE TOOL CO., INC., Clinton, Ind., manufacturer of the Clinton hydraulic duplicator, atomic mill, and special hydraulic machinery, has purchased from the LINCOLN TOOL SPECIALTY CO., Chicago, Ill., all the manufacturing and sales rights to the Eklind-Lincoln milling head.

T. P. UNDERWOOD has been appointed head of the Indianapolis office of the Vanadium-Alloys Steel Co., Latrobe, Pa. Mr. Underwood was a member of the company's Pittsburgh staff before the war.

GEORGE F. HEATH, 4030 Chouteau Ave., St. Louis 10, Mo., has been appointed district sales representative for the CLEVELAND WORM & GEAR CO. and the FARVAL CORPORATION, Cleveland, Ohio.

Michigan

DARDELET THREADLOCK CORPORATION, Detroit 11, Mich., announces that the name of the corporation has been changed to LOCK THREAD CORPORATION in order to give a more accurate idea of the company's product. The LAMSON & SESSIONS CO. and the CHANDLER PRODUCTS CORPORATION, both of Cleveland, Ohio, have recently become agents for the "Lok-Thred" products of the company.

R. R. HUTCHINSON has been appointed assistant chief engineer of the Pontiac Motor Division, General Motors Corporation, Pontiac, Mich., to fill the vacancy created by the promotion of GEORGE A. DELANEY to the post of chief engineer. BEN H. ANIBAL, formerly chief engineer, recently became administrative assistant to the general manager, HARRY J. KLINGLER.

GEORGE N. SIEGER, president of the S-M-S Corporation, Detroit, Mich., was elected president of the Resistance Welder Manufacturers Association at its annual meeting in Detroit, Mich., on January 17. T. S. LONG, vice-president and general manager of the Taylor-Winfield Corporation, Warren, Ohio, was elected vice-president.

$3000.00 AND WORTH A LOT MORE!

A pair of solid Kennametal Rolls, 3" diameter, 8½" face, for cold rolling of steel.

- UP TO 50-100 TIMES AS MUCH STRIP ROLLED BETWEEN GRINDS
- RECONDITIONING REQUIRES LESS STOCK REMOVAL
- INCREASED PRODUCTION DUE TO LESS DOWN TIME
- GREATER REDUCTION PER PASS IF WORK PERMITS
- SUPERIOR PRODUCT, ACCURATE GAGE, BETTER FINISH

The Savings Thus Effected Have Paid For The Cost of Kennametal Rolls in A Very Short Time!

Kennametal Rolls are amazingly hard (78 Rockwell C compared to 66 for hardest tool steel)—*high resistance to abrasion.* Modulus of elasticity is 2 to 3 times that of steel—*greater rigidity under load.* Structure is dense and uniform—*can be given long-lasting, mirror-like finish.* Contain $WTiC_2$—*greater resistance to galling than steel or tungsten carbide rolls.* This distinctive intermetallic compound (tungsten-titanium carbide), is the same ingredient that has made Kennametal outstanding in metal-working industries because it effectively resists the "cratering" action of steel chips, and therefore greatly lengthens tool life.

Kennametal Rolls are made to order, and can be produced in sizes up to 6" diameter, 40" length.

KENNAMETAL

SUPERIOR CEMENTED CARBIDES

TRADE MARK REG. U. S. PAT. OFF.

KENNAMETAL Inc., LATROBE, PA

D. J. DUNLOP, formerly general night superintendent of the Pontiac Motor Division, General Motors Corporation, Pontiac, Mich., has been made assistant to the general manufacturing manager, S. W. OSTRANDER. BUELL E. STARR, formerly general day superintendent, is now manufacturing manager.

ROY FARQUHARSON has been promoted to the position of assistant chief engineer of the Pioneer Engineering & Mfg. Co., Detroit, Mich. He has been connected with the company for eleven years, and has had more than twenty years of experience in designing tools, dies, and fixtures.

CARBOLOY COMPANY, INC., Detroit, Mich., has appointed the KENDALL HARDWARE-MILL SUPPLY Co., 225 W. Michigan Ave., Battle Creek, Mich., distributor for the cemented-carbide tipped tools and other hard metal carbide products of the company in the Battle Creek and Kalamazoo areas.

PERRY D. GASNIER has been appointed manager of the recently established Detroit office of the Davis & Thompson Co., Milwaukee, Wis., manufacturer of machine tools. Mr. Gasnier was previously connected with the Cincinnati Milling Machine Co. in the capacity of sales and field engineer.

H. A. ROEMER, JR., has been elected vice-president of the Sharon Steel Corporation, Sharon, Pa. Mr. Roemer is president of the Detroit Seamless Steel Tubes Co., a subsidiary of the Sharon Steel Corporation, and will retain that position, with headquarters in Detroit.

D. S. HARDER has resigned as chairman of the board and director of the E. W. Bliss Co., Detroit, Mich., to devote his entire time to his duties as vice-president in charge of operations for the Ford Motor Co.

HARRY E. DAVIES, formerly factory manager of the Hannifin Mfg. Co., Chicago, Ill., has been made manager of Bridgman Castings, Inc., Bridgman, Mich., a Hannifin subsidiary.

E. LABADIE, of the process engineering department of the Progressive Welder Co., 3050 E. Outer Drive, Detroit 12, Mich., has been advanced to the post of service manager.

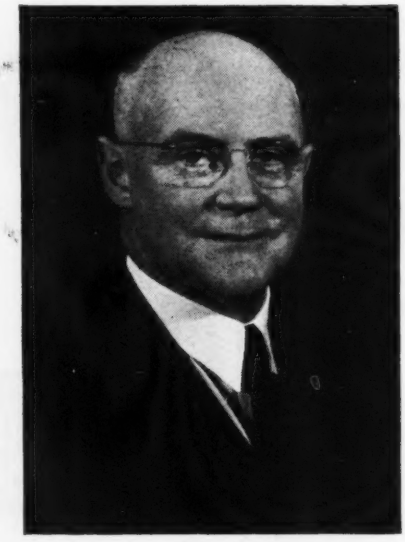
Minnesota and Wisconsin

L. M. MORLEY has been elected a vice-president of the Minneapolis-Honeywell Regulator Co., Minneapolis, Minn. Mr. Morley, vice-president in charge of sales for the Brown Instrument Co., Philadelphia, Pa.—a Honeywell subsidiary—will continue to supervise sales of the industrial control devices made by the Brown Division.

RALPH D. HOLCOMB has been appointed general sales manager of the Harnischfeger Corporation, Milwaukee, Wis., manufacturer of hoists, cranes, welding equipment, and road machinery.

New England

CHARLES W. DEEDS has resigned as president and general manager of the Niles-Bement-Pond Co., West Hartford, Conn., but will continue to serve as a director. Mr. Deeds plans



Frederick U. Conard, New President and General Manager, Niles-Bement-Pond Co.

to devote his full time to his widely diversified personal interests outside of the company, and will maintain an office in Hartford. FREDERICK U. CONARD, vice-president of the Underwood Corporation, succeeds Mr. Deeds as president and general manager. Mr. Conard graduated from Stevens Institute of Technology in 1915 with the degree of mechanical engineer, and has had extensive engineering experience. He entered the employ of the Underwood Corporation in February, 1919, as chief engineer, after being released from service in World War I, and has been associated with that company ever since in various capacities.

R. V. BERGSTROM has been appointed abrasive engineer in the Cleveland area for the Norton Co., Worcester, Mass., succeeding H. W. COBB, who has been made office manager of the Cleveland warehouse. E. D. LINTON, formerly Cleveland office manager, returns to Worcester as merchandising engineer. E. J. LALER has been made abrasive engineer in the Erie, Pa., territory, succeeding J. L. MOSER.

RAYMOND D. CRITZER has been appointed sales engineer in the Cleveland district for the Leland-Gifford Co., Worcester, Mass., manufacturer of machine tools. A. P. WITTEMAN, who has been in charge of this territory for the last eleven years, will head the new Los Angeles office of the company, which is being opened on April 1 in the Corporation Bldg., S. Spring St., Los Angeles, Calif.

REASONER TOOL & SUPPLY Co., 144 Pearl St., Boston, Mass., has been designated gage and instrument representative in eastern Massachusetts, Maine, New Hampshire, and Vermont for the SHEFFIELD CORPORATION, Dayton, Ohio. RICHARD S. BROWN, Wilbraham, Mass., has been appointed machine tool representative for the company in the same territory.

EVERETT M. HICKS, formerly assistant controller of the Norton Co., Worcester, Mass., has been appointed assistant manager of the Grinding Machine Division. He will be succeeded as assistant controller by JULIUS F. LOVELL. CHARLES M. KRANE has been appointed field engineer for the company, with headquarters in Hartford, Conn.

TECHNICAL PRODUCTS CO., INC., manufacturer of gears, has recently moved into its new plant at Acton, Mass. The mailing address is Box 55, West Concord, Mass.

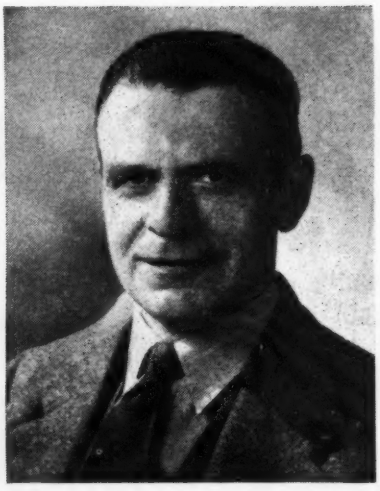
LORD MFG. CO., manufacturer of vibration control mountings and flexible couplings, announces the establishment of a new field office in the Industrial Trust Bldg., Providence, R. I., with DAN ROWAN in charge.

New Jersey

RALPH E. GORDINIER has been made chief research and design engineer for the Eco Engineering Co., 71 New York Ave., Newark, N. J., manufacturer of the Eco gearless pump for the circulation of water, brine, coolants, and light liquids.

MAGNOLIA METAL CO., 18 W. Jersey St., Elizabeth, N. J., announces the acquisition of the EVANS ENGINEERING Co., 1461 Arcadian Ave., Waukesha, Wis., manufacturer of "fusion bonded" sleeve bearings.

WARNER & SWASEY Co., Cleveland, Ohio, announces the removal of its Newark, N. J., offices to 19 N. Harrison St., East Orange, N. J.



(Left to Right) Harold V. Rasmussen, Chief Engineer of the Turbine Department of the De Laval Steam Turbine Co.; Hans Gartmann, Chief Engineer of Centrifugal Pump and Compressor Department; and Harry Engvall, Chief Engineer of Helical Gear Department

HAROLD V. RASMUSSEN has been appointed chief engineer of the turbine department of the De Laval Steam Turbine Co., Trenton, N. J.; HANS GARTMANN, chief engineer of the centrifugal pump and compressor department of the company; and HARRY ENGVALL, chief engineer of the helical gear department.

GORDON J. WYGANT, formerly sales engineer for Titeflex, Inc., Newark, N. J., has been named assistant sales manager of the company.

New York

WESTINGHOUSE ELECTRIC CORPORATION, Pittsburgh 30, Pa., announces that plans have been made to expand the manufacturing facilities of the corporation's Buffalo, N. Y., plant. In the future, this division, which was formerly a part of the Switchgear and Control Division, will be known as the Industrial Control Division. Fifteen hundred persons will be added to the payroll at Buffalo when operations are fully under way, bringing the total employment at that division to 7200 persons.

COSA CORPORATION, Chrysler Bldg., New York City, has recently been appointed representative in the United States for the GEORGE FISCHER STEEL & IRON WORKS LTD., of Schaffhausen, Switzerland, manufacturers of a hydro-copying lathe recently shown to American industry at an exhibition at the Rochester Institute of Technology. This machine is designed especially to meet the requirements of tungsten-carbide tooling.

WILLIAM C. BEDDOE has been appointed advertising and sales promotion manager of Divine Brothers Co., Utica, N. Y., manufacturer of polishing and buffing wheels, machine finishing machinery and supplies, and truck wheels and casters.

NILSSON GAGE CO., INC., Poughkeepsie, N. Y., has organized a renewal service for restoring to their original dimensions ring and plug gages that have been worn beyond tolerance size.

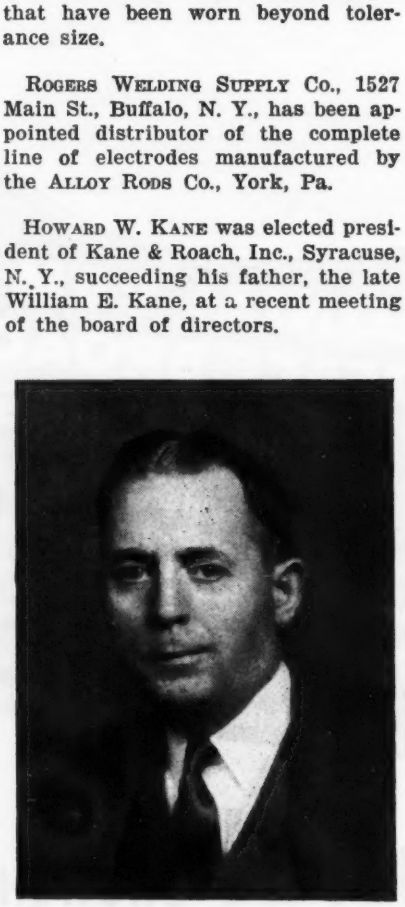
ROGERS WELDING SUPPLY CO., 1527 Main St., Buffalo, N. Y., has been appointed distributor of the complete line of electrodes manufactured by the ALLOY RODS CO., York, Pa.

HOWARD W. KANE was elected president of Kane & Roach, Inc., Syracuse, N. Y., succeeding his father, the late William E. Kane, at a recent meeting of the board of directors.

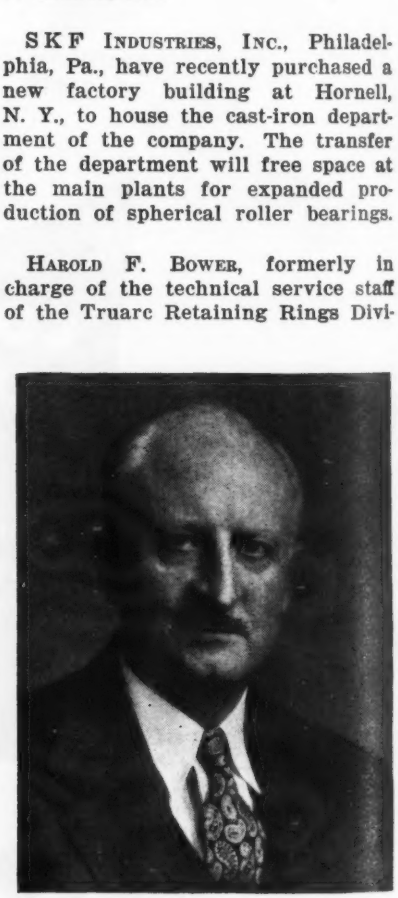
H. J. FRASER and H. J. FRENCH have been elected vice-presidents of the International Nickel Co., Inc., 67 Wall St., New York 5, N. Y. Mr. Fraser has been assistant vice-president since June, 1943. Both he and Mr. French are assistant vice-presidents of the International Nickel Co. of Canada, Ltd.

SKF INDUSTRIES, INC., Philadelphia, Pa., have recently purchased a new factory building at Hornell, N. Y., to house the cast-iron department of the company. The transfer of the department will free space at the main plants for expanded production of spherical roller bearings.

HAROLD F. BOWER, formerly in charge of the technical service staff of the Truarc Retaining Rings Divi-

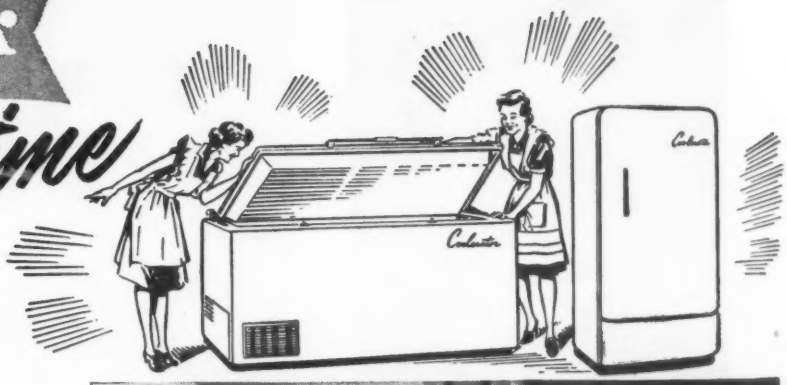


Howard W. Kane, Newly Elected President of Kane & Roach, Inc.



Harold F. Bower, Sales Manager, Truarc Retaining Rings Division of Waldes Kohinoor

Coolerator saves costly time Training New Assembly Workers by using PHILLIPS SCREWS



Highlights from a comprehensive report by independent investigator of James O. Peck Co.—one of their studies of assembly savings made with Phillips Screws in leading plants . . .

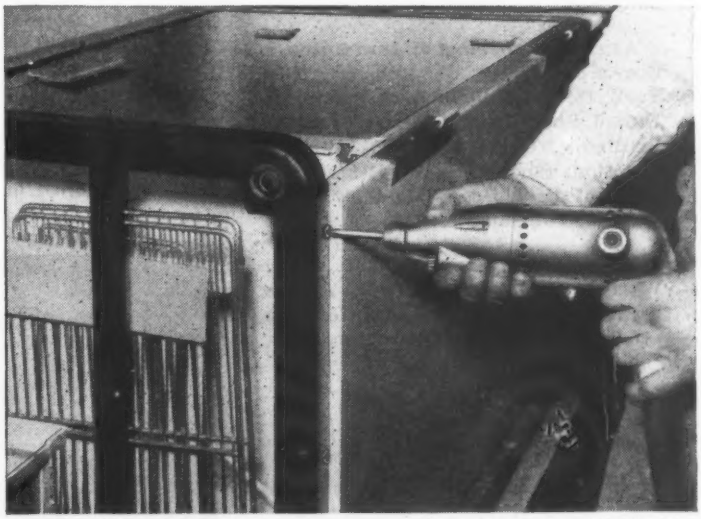
• "WE made an important saving we hadn't counted on when we switched to Phillips Recessed Head Screws," said the foreman of Coolerator's assembly line. "Instead of the expensively long period usually required to train operators to drive slotted screws, we found that new people could start driving Phillips Screws with a few simple instructions. Since we use about 125 Phillips Screws in every Coolerator and our daily production is 800, there isn't much time for teaching anyone how to drive a screw.

"EASIER TO USE, especially in awkward or blind applications . . . like fastening the black base to the bottom of the unit or attaching the ice container to the box. You have practically no control over slotted screws, while Phillips Screws are easy to line up.

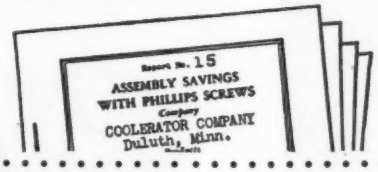
"STOPPED PANEL DAMAGE and burring of heads. Assembly people used to almost write their names on the sides of the units when a slotted screw driver slipped. That cost real money . . . for disassembly, refinishing and reassembly, not to mention the disruption of the assembly line. Phillips Screws ended slips.

THE WHOLE STORY of this and other assembly studies in key plants . . . covering metal, wood and plastic products . . . will suggest similar savings to any production man. This coupon will bring you these reports—FREE. Mail it now.

Here's a tricky bit of "blind" driving . . . through a small hole in the ice unit. With Phillips Screws, locating and driving is easier.



If ordinary slotted screws were used in fastening this black enameled base, inevitable driver slippage would do costly damage to the adjacent panels.



Phillips Screw Mfrs., c/o Horton-Noyes
1800 Industrial Trust Bldg.,
Providence, R. I.

Send me reports on Assembly Savings with Phillips Screws.

Name .....

Company .....

Address .....

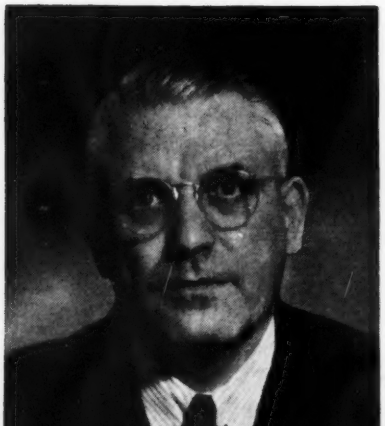
M-16

PHILLIPS *Recessed Head* SCREWS

Wood Screws • Machine Screws • Self-tapping Screws • Stove Bolts

23 SOURCES

American Screw Co.
Central Screw Co.
Continental Screw Co.
Corbin Screw Div. of American Hdwe. Corp.
The H. M. Harper Co.
International Screw Co.
Lamson & Sessions Co.
Milford Rivet and Machine Co.
National Lock Co.
National Screw & Mfg. Co.
New England Screw Co.
Parker-Kalon Corporation
Pawtucket Screw Co.
Pheoll Manufacturing Co.
Reading Screw Co.
Russell Burdsall & Ward Bolt & Nut Co.
Scovill Manufacturing Co.
Shakeproof Inc.
The Southington Hardware Mfg. Co.
The Steel Company of Canada, Ltd.
Sterling Bolt Co.
Stronghold Screw Products, Inc.
Wolverine Bolt Company



A. J. Sherman, Factory Superintendent of the Monarch Machine Tool Co.

Jesse W. Elliott, Assistant Superintendent of Monarch Machine Tool Co.

sion of Waldes Kohinoor, Inc., Long Island City, N. Y., has been named sales manager of the division.

ERIC J. YOUNG has joined Production Methods, Inc., 48 E. 43rd St., New York 17, N. Y., in the capacity of senior design engineer. He was previously engaged in design and research engineering for the S. S. White Dental Mfg. Co. at the company's Staten Island plant.

AMERICAN MEASURING INSTRUMENTS CORPORATION, 240 W. 40th St., New York 18, N. Y., has been appointed United States representative for the PRECISION GRINDING Co., Mitcham Junction, Surrey, England, manufacturer of Profiloscopes and other optical instruments.

HANSEN & YORKE CO., INC., 86-90 Warren St., New York 7, N. Y., has been appointed distributor for the products of the CARBOLOY COMPANY, Inc., Detroit, Mich.

Ohio

PRECISION WELDER & MACHINE CO., Cincinnati, Ohio, manufacturer of resistance welding machines, announces the appointment of the following distributors for spot, seam, flash, projection, and portable welders: HOSLER & Co., Indianapolis, Ind.; MACHINERY & WELDER CO., St. Louis, Mo.; J. A. CUNNINGHAM EQUIPMENT CO., Philadelphia, Pa.; and CANADIAN FAIRBANKS MORSE CO., Montreal, Canada.

A. J. SHERMAN has been made factory superintendent and JESSE W. ELLIOTT assistant superintendent of the Monarch Machine Tool Co., Sidney, Ohio. Mr. Sherman has been connected with the company since 1916, and Mr. Elliott since 1935.

C. E. JONES has been appointed vice-president of the Agaloy Tubing Co., Springfield, Ohio. He has been connected with the steel industry since 1932, and has been associated with the Agaloy Tubing Co. since his release from the Navy.

ANTON ERHARDT, SR., has been appointed chief engineer of the National Tool Co., Cleveland, Ohio. During his forty years of service with the company he has progressively advanced through the various departments until he became factory superintendent, the office he held at the time of his recent promotion. JAMES C. GROSSMAN succeeds Mr. Erhardt as factory superintendent. He was previously production manager with the Cleveland Automatic Machine Co.

EDMOND J. MCSWEENEY has been elected vice-president in charge of manufacturing of the Hydraulic Press Mfg. Co., Mount Gilead, Ohio. Prior to his present connection, Mr. McSweeney had served as president of the Vulcan Iron Works, Wilkes-Barre, Pa., and as general superintendent of motive power with the Baltimore & Ohio Railroad. He succeeds R. J. WHITING, who has resigned for reasons of health.

YODER DIE-CASTING, INC., 631 Wayne Ave., Dayton, Ohio, has made plans for the erection of a new plant on Kiser St., which it is expected will be ready for occupancy within six months. The new building will be 40 by 130 feet in size, and will contain 6000 square feet of manufacturing space—double the present capacity.

LEO J. PERRETTE, 2162 Gilbert Ave., Cincinnati, Ohio, has been appointed a representative of Kennametal, Inc., Latrobe, Pa. Mr. Perrette was previously a member of the Kennametal staff of application engineers.

D. A. PATTERSON has succeeded his father, the late L. B. Patterson, as president of the Avey Drilling Machine Co., Inc., Cincinnati, Ohio, manufacturer of ball-bearing drilling machines.

DAVID E. JOHNSON has recently been appointed a vice-president of the Steel Improvement & Forge Co.,

Anton Erhardt, Sr., Newly Appointed Chief Engineer of National Tool Co.

James C. Grossman, Factory Superintendent of National Tool Co.

Cost of machine frame reduced 50% by change to welded design

BY LOUIS FAULB, PRESIDENT
KLEEN-KUT MANUFACTURING COMPANY
CLEVELAND, OHIO

Production cost of the frame of the Kleen-Kut meat saw manufactured by our company has been reduced more than 50% by redesigning it for fabrication by arc welding. The former design and the latest welded design are shown in Fig. 1.

The new design has reduced machining operations 60%, has made the machine six times as rigid, cut its weight from 550 to 350 pounds, and has doubled the production output of the same floor area.

The changeover to all-welded design was an evolutionary process over an 18-month period.

We started with the table frame shown in Fig. 3, and the cost reduction encouraged us to redesign the whole machine. Since our original all-welded design, we have made 40 improvements. If we had used conventional fabricating methods, 40 modifications or complete changes in patterns would have been necessary. Open views of the original welded design and the latest welded design are shown in Fig. 2.

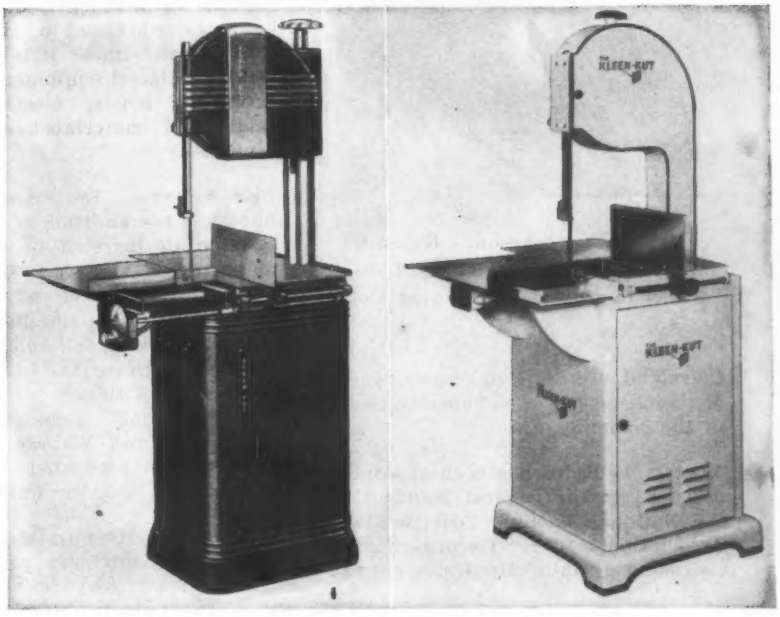


Fig. 1. Saw of former conventional design (left) and all-welded design (right).

IMPROVES THE PRODUCT

Welded design has increased the saw's overall rigidity and strength. The top pulley support, subject to considerable stresses, was stiffened by simply welding a 32-inch length of angle vertically inside the housing. Rigidity was further aided by widening the main frame to the full length of the base and redesigning the door.

Adjusting the saw blade tension in the former model required moving the entire head of the unit up or down, which took too much time. In the new design this adjustment is made by simply turning a rod. To incorporate this feature in the former design would have meant an excessive amount of machining.

INTERMITTENT WELDS USED

The new saw frame is made largely of formed plates, reinforced at strategic stress points with gussets and cross-braces. A minimum of material and welding is used, most parts being fused with intermittent welds like those in the table frame (Fig. 3). This type of welding obtains proper strength, avoids distortion and speeds production.

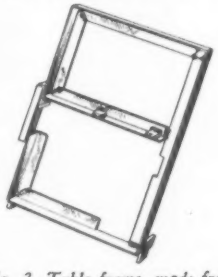


Fig. 3. Table frame, made from angles. This is the first part that was changed to welded design.

The table frame is constructed of 1½-inch angles with ½-inch bearing brace. The machine base consists of four ¼-inch plates joined by fillet welds in open corner joints. The main stand is 3/16-inch-thick steel sheet with inside fillet joints. Bearing and pin bosses are solid welded into the structure. Hinged covers are 14 gauge steel sheet.

Wherever possible, welding is done on the inside of the joint to give a smooth exterior appearance. Because materials are light-weight, all parts can be easily handled for bench-welding.

The reduction in machining operations has enabled us to double our production within the same floor area. Materials-procurement has also been simplified. Previously we ordered parts from seven outside firms; now we make them all in our own plant with simple, low-cost production facilities.

In approaching redesigning problems, our engineers have been aided by the Studies in Machine Design issued periodically by The Lincoln Electric Company. These are available free to engineers and designers who write The Lincoln Electric Company, Dept. 223, Cleveland 1, Ohio.

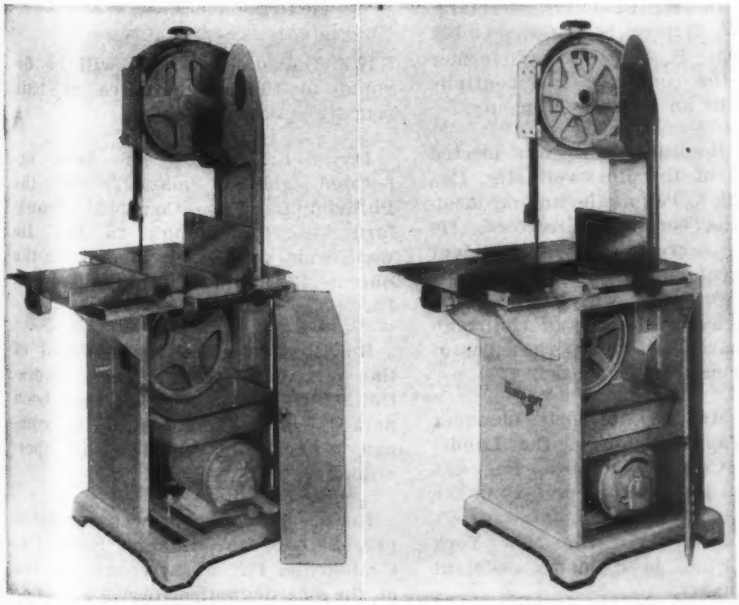


Fig. 2. Original welded design (left) and latest welded design (right) with covers open to show interiors.

David E. Johnson, Recently Appointed Vice-president of the Steel Improvement & Forge Co.

Cleveland, Ohio. For many years Mr. Johnson has been superintendent of the company.

ALVIN L. KRIEG has been appointed assistant to the general manager of the National Machine Tool Builders' Association, 10525 Carnegie Ave., Cleveland 6, Ohio. Mr. Krieg goes to

Alvin L. Krieg, Assistant to General Manager of the N.M.T.B.A.

his new post from the American Steel & Wire Co., where he was assistant to the director of public relations.

R. K. LEBLOND MACHINE TOOL CO., Cincinnati 8, Ohio, has opened direct sales offices in Philadelphia at 3701 N. Broad St., 821-22 Beury Bldg., with N. J. KOPPI in charge. The CALCO MACHINERY CO. was formerly representative in Philadelphia.

Pennsylvania

YALE & TOWNE MFG. CO., Philadelphia, Pa., has made plans for the erection of a 600,000 square foot plant in Philadelphia to replace the present plant at 4530 Tacony St. The construction will include an office building with a capacity of 100,000 square feet. The new plant will have a capacity for about 3000 employes working on one shift, or 900 more than are working in the present plant on two shifts. It is planned to install the latest equipment for manufacturing hoists, electric trucks, scales, and materials-handling machinery.

KENNAMETAL, INC., Latrobe, Pa., announces the addition of the following men to its staff of application engineers: A. V. ANDREWS and JOHN L. SULLIVAN, 600 Grant St., Pittsburgh, Pa.; GERALD BOGNER, 860 Hanna Building, Cleveland, Ohio; CHARLES R. DEMMITT, JR., 9 N. Jefferson St., Chicago, Ill.; ROBERT KARAKOOSH, 1537 Main St., Springfield, Mass.; and WALTER C. LAVERS and JOSEPH F. LIEBSCHER, 3715 Santa Fe Ave., Los Angeles, Calif.

JOSEPH G. HOLZSCHUH has been appointed sales engineer covering the Pittsburgh territory for the E. W. Bliss Co., Detroit, Mich., manufacturer of mechanical and hydraulic presses and can machinery. He will be located at the company's newly established office in the Verhovey Bldg., 436 Fourth Ave., Pittsburgh 19, Pa. Mr. Holzschuh was previously in charge of the Eastman Kodak's press department.

P. A. PATTERSON CO., INC., 3115 N. Broad St., Philadelphia, Pa., representative of machine and tool manufacturers, has been reorganized, with JOHN C. WILCOX as president; ROBERT J. PEEL, vice-president and treasurer; and FRANK W. PUGSLEY, secretary. LESTER W. WILCOX is also a member of the firm. P. A. PATTERSON, former head of the company, will continue to serve in an advisory capacity.

W. F. ROCKWELL, JR., was elected president of the Rockwell Mfg. Co., Pittsburgh 8, Pa., at the annual meeting of the board of directors. He formerly served as vice-president and general manager. COLONEL WILLARD F. ROCKWELL, who has been acting both as president and chairman of the board, will retain the office of the chairman of the board.

R. G. MUMMA, formerly manager of the Tap Division of the Landis Machine Co., Waynesboro, Pa., has been named assistant secretary of the company, and R. E. YINGLING, previously in charge of the New York territory, has been made assistant sales manager.

WILLIAM D. TAYLOR, who has been engineer of tests for the Lukens Steel Co., Coatesville, Pa., has been appointed assistant metallurgical engineer, and SAMUEL D. LEMMON, assistant engineer of tests, has been advanced to replace Mr. Taylor as engineer of tests.

ADVANCED TOOL & DESIGN CO. announces the removal of its offices from 710 Lewis Tower, 15th and Locust Sts., Philadelphia 2, Pa., to 228 S. Fourth St., Philadelphia 6, Pa.

JOHN E. PAYNE has been appointed headquarters industrial sales manager for the Westinghouse Electric Corporation, Pittsburgh 30, Pa.

FRED A. MASER has been appointed superintendent of the recently acquired Shippensburg, Pa., plant of

Fred A. Maser, Superintendent of the Shippensburg Plant of SKF Industries, Inc.

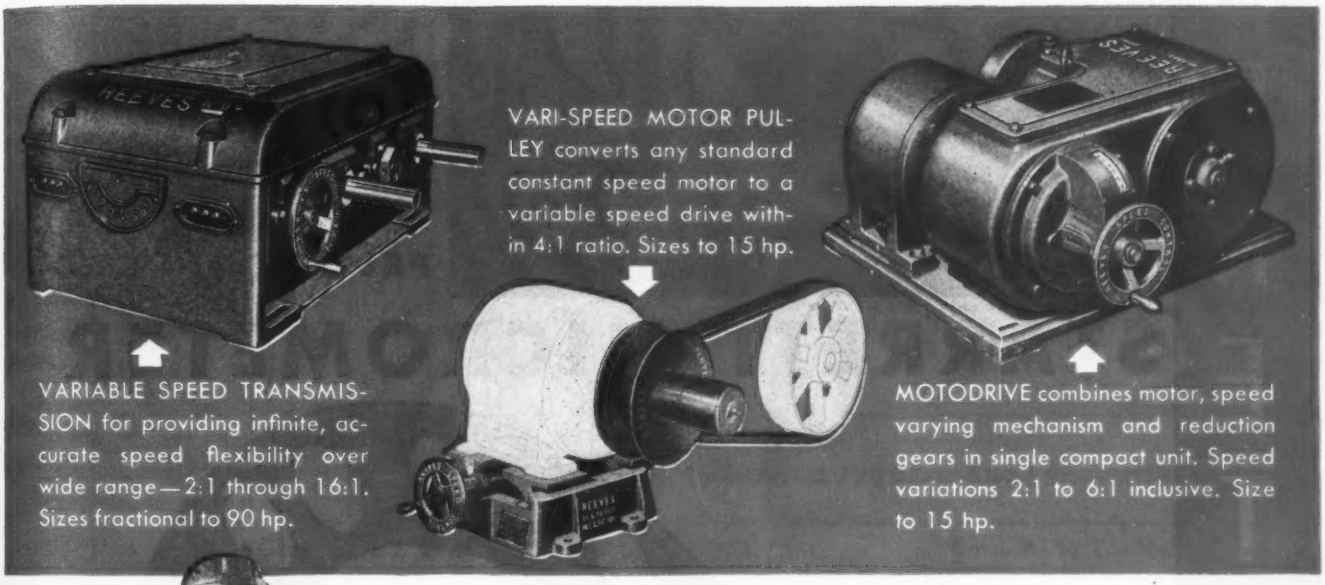
SKF Industries, which will be devoted to the manufacture of ball-bearing retainers.

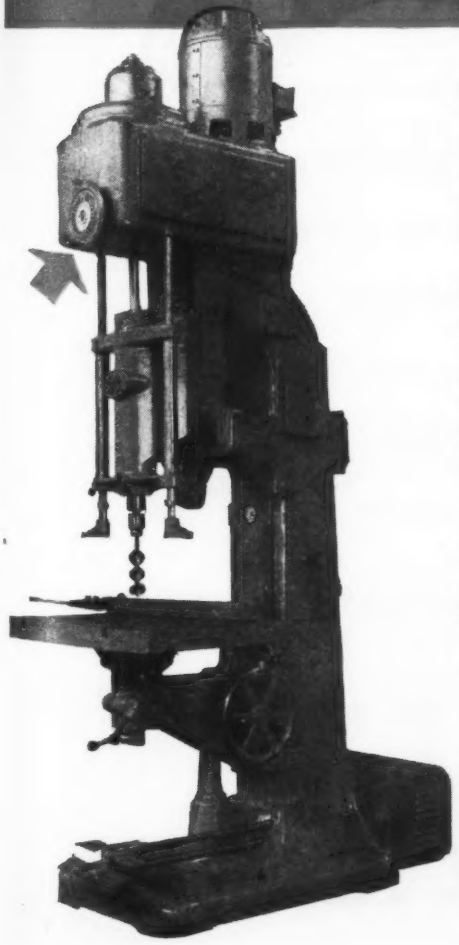
DAVID E. LUKENS has been appointed general manager of the Philadelphia Tube Co., 1121 Frankford Ave., Philadelphia 25, Pa. He was formerly sales engineer with the Summerill Tubing Co. of Bridgeport, Pa.

ROBERT A. NEAL, vice-president of the Westinghouse Electric Corporation, Pittsburgh 30, Pa., has been named general manager of the company's expanding Pacific Coast operations.

ROBERT W. WOLCOTT was re-elected president of the Lukens Steel Co., Coatesville, Pa., at a recent meeting of the board of directors.

Modern Reeves Speed Control for Modern Machines





● REEVES Speed Control—without stoppage or slow-down—provides instant and accurate adjustment of machine speed to the requirements of the job at hand and to the skill of the operator involved. It widens the machine's work range, permits it to do more different jobs and more work with greatest accuracy, uniformity and efficiency. In short, modern REEVES Speed Control is the mark of modern, productive, profitable machines throughout Industry.

REEVES units, manufactured in a wide range of sizes, designs, speed ratios and furnished with all types of controls, are easy for the mechanic to maintain and service without special tools or training. Now standard equipment on 2,100 different makes of machines, REEVES Speed Control is also easily applied to machines in service. So, in buying new machines, or in modernizing old ones, make sure of modern performance by specifying modern REEVES Speed Control. A nation-wide staff of experienced engineers is available for consultation . . . for complete information write for catalog M-450.

Arrow in photo at left indicates position of the REEVES *Motodrive (internal operating parts only) which is furnished as standard equipment on this Single Spindle Borer, manufactured by the B. M. Root Company, York, Pa. An unusual feature of this machine is the fact that the spindle moves vertically in a splined bushing fitted into variable disc of the* REEVES *unit, providing instant, infinite speed adjustability.*

REEVES PULLEY COMPANY • COLUMBUS, INDIANA

Recognized Leader in the Specialized Field of Speed Control Engineering

Accurate Variable

REEVES Speed Control

Gives the Right Speed for Every Job!

CHECKING INTERNAL GEAR SIZES BY MEASUREMENT BETWEEN WIRES—1

Even Numbers of Teeth

The dimensions given in this table are for 1 diametral pitch gears and wires of 1.68-inch diameter. For checking gears of any other pitch, divide the dimensions given by the diametral pitch and use wires having a diameter equal to $\frac{1.68}{\text{diametral pitch}}$

No. of Teeth	Pressure Angle				
	14½ deg.	17½ deg.	20 deg.	25 deg.	30 deg.
6	1.68" WIRES TOO LARGE				
8					5.5304
10				7.5173	7.5850
12				9.5899	9.6083
14				11.6200	11.6225
16			13.5459	13.6377	13.6320
18			15.5901	15.6496	15.6387
20			17.6147	17.6581	17.6438
22		19.5486	19.6311	19.6646	19.6478
24		21.5786	21.6429	21.6697	21.6510
26		23.5983	23.6520	23.6739	23.6537
28		25.6126	25.6591	25.6773	25.6559
30		27.6235	27.6649	27.6801	27.6577
32	29.4774	29.6322	29.6699	29.6826	29.6593
34	31.5095	31.6394	31.6739	31.6847	31.6607
36	33.5314	33.6453	33.6773	33.6866	33.6619
38	35.5472	35.6504	35.6804	35.6882	35.6630
40	37.5599	37.6548	37.6831	37.6895	37.6640
42	39.5702	39.6586	39.6855	39.6907	39.6648
44	41.5788	41.6619	41.6875	41.6918	41.6656
46	43.5861	43.6648	43.6893	43.6929	43.6663
48	45.5924	45.6675	45.6910	45.6939	45.6669
50	47.5979	47.6699	47.6926	47.6948	47.6676
52	49.6027	49.6721	49.6940	49.6956	49.6681
54	51.6070	51.6741	51.6953	51.6963	51.6686
56	53.6109	53.6759	53.6965	53.6970	53.6691
58	55.6144	55.6775	55.6975	55.6976	55.6695
60	57.6175	57.6789	57.6985	57.6981	57.6699
62	59.6204	59.6802	59.6994	59.6987	59.6703
64	61.6230	61.6815	61.7003	61.6992	61.6706
66	63.6254	63.6827	63.7011	63.6996	63.6709
68	65.6277	65.6838	65.7018	65.7001	65.6712
70	67.6297	67.6849	67.7025	67.7005	67.6715
72	69.6316	69.6859	69.7032	69.7008	69.6718
74	71.6334	71.6868	71.7038	71.7012	71.6720
76	73.6351	73.6876	73.7044	73.7015	73.6723
78	75.6366	75.6884	75.7049	75.7019	75.6725
80	77.6381	77.6891	77.7054	77.7022	77.6727
82	79.6395	79.6898	79.7059	79.7025	79.6729
84	81.6408	81.6905	81.7064	81.7027	81.6731
86	83.6420	83.6912	83.7068	83.7030	83.6733
88	85.6431	85.6918	85.7072	85.7032	85.6734
90	87.6442	87.6924	87.7076	87.7035	87.6736
92	89.6452	89.6929	89.7080	89.7037	89.6738
94	91.6462	91.6934	91.7084	91.7039	91.6739

MACHINERY'S Data Sheet No. 583, April, 1947 Compiled by The Van Keuren Co. Boston, Mass.

CHECKING INTERNAL GEAR SIZES BY MEASUREMENT BETWEEN WIRES—2

Even Numbers of Teeth

No. of Teeth	Pressure Angle				
	14½ deg.	17½ deg.	20 deg.	25 deg.	30 deg.
96	93.6472	93.6939	93.7087	93.7041	93.6741
98	95.6481	95.6944	95.7090	95.7043	95.6742
100	97.6489	97.6949	97.7093	97.7045	97.6744
102	99.6497	99.6953	99.7096	99.7047	99.6745
104	101.6505	101.6957	101.7099	101.7049	101.6746
106	103.6512	103.6961	103.7102	103.7050	103.6747
108	105.6519	105.6965	105.7105	105.7052	105.6748
110	107.6526	107.6969	107.7107	107.7053	107.6750
112	109.6532	109.6973	109.7110	109.7055	109.6751
114	111.6538	111.6976	111.7112	111.7056	111.6752
116	113.6544	113.6979	113.7114	113.7058	113.6753
118	115.6550	115.6982	115.7117	115.7059	115.6754
120	117.6556	117.6985	117.7119	117.7060	117.6755
122	119.6561	119.6988	119.7121	119.7062	119.6756
124	121.6566	121.6991	121.7123	121.7063	121.6756
126	123.6571	123.6994	123.7125	123.7064	123.6757
128	125.6575	125.6996	125.7127	125.7065	125.6758
130	127.6579	127.6999	127.7129	127.7066	127.6759
132	129.6583	129.7001	129.7130	129.7067	129.6759
134	131.6588	131.7004	131.7132	131.7068	131.6760
136	133.6592	133.7006	133.7134	133.7069	133.6761
138	135.6596	135.7008	135.7135	135.7070	135.6761
140	137.6600	137.7010	137.7137	137.7071	137.6762
142	139.6604	139.7012	139.7139	139.7021	139.6763
144	141.6608	141.7014	141.7140	141.7073	141.6763
146	143.6612	143.7016	143.7141	143.7074	143.6764
148	145.6615	145.7018	145.7143	145.7075	145.6765
150	147.6618	147.7020	147.7144	147.7076	147.6765
152	149.6621	149.7022	149.7145	149.7077	149.6766
154	151.6624	151.7024	151.7146	151.7077	151.6766
156	153.6627	153.7026	153.7148	153.7078	153.6767
158	155.6630	155.7027	155.7149	155.7079	155.6768
160	157.6633	157.7029	157.7150	157.7079	157.6768
162	159.6636	159.7031	159.7151	159.7080	159.6768
164	161.6639	161.7033	161.7152	161.7080	161.6769
166	163.6642	163.7034	163.7153	163.7081	163.6769
168	165.6645	165.7035	165.7154	165.7082	165.6770
170	167.6647	167.7036	167.7156	167.7082	167.6770
180	177.6658	177.7044	177.7160	177.7085	177.6772
190	187.6668	187.7049	187.7164	187.7088	187.6774
200	197.6678	197.7054	197.7168	197.7090	197.6776
300	297.6735	297.7088	297.7192	297.7105	297.6786
400	397.6762	397.7104	397.7203	397.7112	397.6791
500	497.6778	497.7113	497.7210	497.7117	497.6795
∞	(N—3).6841	(N—3).7151	(N—3).7238	(N—3).7134	(N—3).6808

These data for 1 diametral pitch gears and 1.68-inch diameter wires are based on the Buckingham formulas for measurement of internal spur gears between wires.

MACHINERY'S Data Sheet No. 584, April, 1947 Compiled by The Van Keuren Co. Boston, Mass.

Coming Events

APRIL 22-23 — MACHINE TOOL ELECTRIFICATION FORUM at the Hotel Statler, Buffalo, N. Y., sponsored by the Westinghouse Electric Corporation, Pittsburgh 30, Pa.

MAY 1-2 — Aircraft meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Hotel Lassen, Wichita, Kansas. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

MAY 5-11—NATIONAL PLASTICS EXPOSITION at the Coliseum, Chicago, Ill., under the auspices of the Society of the Plastics Industry, Inc., 295 Madison Ave., New York 17, N. Y.

MAY 26-29 — Meeting of the Aviation Division of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS in Los Angeles, Calif. Secretary, Clarence E. Davies, 29 W. 39th St., New York City.

JUNE 1-6—Summer meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the French Lick Springs Hotel, French Lick, Ind. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

JUNE 2-4—Thirty-first annual meeting of the AMERICAN GEAR MANUFACTURERS ASSOCIATION at Hot Springs, Va. Newbold C. Goin, executive secretary, Empire Bldg., Pittsburgh 22, Pa.

JUNE 16-19—Semi-annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Stevens Hotel, Chicago, Ill. Secretary, Clarence E. Davies, 29 W. 39th St., New York City.

JUNE 16-20—Annual meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at the Chalfonte-Haddon Hall, Atlantic City, N. J. Secretary, C. L. Warwick, 1916 Race St., Philadelphia, Pa.

SEPTEMBER 1-4—Fall meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Hotel Utah, Salt Lake City, Utah. Secretary, Clarence E. Davies, 29 W. 39th St., New York City.

SEPTEMBER 17-26—MACHINE TOOL SHOW in Chicago, Ill., under the auspices of the National Machine Tool Builders' Association, 10525 Carnegie Ave., Cleveland 6, Ohio.

DECEMBER 1-5—Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS in Atlantic City, N. J.; headquarters, Chalfonte-Haddon Hall. Secretary, Clarence E. Davies, 29 W. 39th St., New York City.

Obituaries

Louis B. Patterson

Louis Britton Patterson, one of the founders of the Avey Drilling Machine Co., Cincinnati, Ohio, died on February 25 at Christ Hospital in Cincinnati. Mr. Patterson had been president and treasurer of the company from its inception up to about one month before his death, when he was forced to relinquish these posts because of failing health, and was succeeded in the presidency by his son, D. A. Patterson. The drilling machine company that Mr. Patterson headed was started by him and the late J. G. Hey, and developed under their direction from a very small beginning to its present important position in the industry.

Eric C. Gyllensvard

Eric C. Gyllensvard, export and New York office manager of the Farrel-Birmingham Co., Inc., Ansonia, Conn., was killed by a stroke of lightning on February 17 while in Sao Paulo, Brazil, on a business trip. Mr. Gyllensvard was born in Sweden, and after attending a preparatory school in Switzerland entered Cambridge University in England, from which he received a B.S. degree in mechanical engineering in 1927. After graduation, he was connected with the Standard Oil Co., first as petroleum engineer and later as sales engineer in the service of the company's subsidiaries abroad. He later joined the Sullivan Machine Co. as export manager, and handled that company's extensive export operations for seven years prior to joining the Farrel-Birmingham Co.

Eric C. Gyllensvard

He had a wide knowledge of the problems of foreign trade, especially in South America and the Far East. In 1942, he was elected president of the Machinery and Metals Export Association and held that post for two terms. During the war years, Mr. Gyllensvard served in an advisory capacity on various government committees in Washington handling export controls. He served in 1942 and 1943 on the Lend-Lease Foreign Trade Council, and later on the Foreign Economic Administration Advisory Committee.

Arthur G. Green

Arthur G. Green, sales manager for the Bay State Abrasive Products Co., Westboro, Mass., died on March 6 in the Memorial Hospital, Worcester, Mass., following an operation, at the age of fifty-one. Mr. Green was a graduate of the Worcester Polytechnic Institute, class of 1918. He became connected with the Bay State Abrasive Products Co. in 1944, and prior to that he had been connected with the Norton Co. for twenty-seven years. He was a member of the American Society of Tool Engineers and the Worcester Sales Executive Club. He is survived by his wife, a son, and a daughter.

Arthur G. Green

HENRY LEROY RANDALL, president of the Riverside Metal Co., Riverside, N. J., died on February 18 at the Riverside Hospital. Mr. Randall joined the Riverside Metal Co. in 1916, and was assistant works manager from 1916 to 1918, becoming president in 1920. He was a native of New Milford, Conn., and graduated from Phillips Academy. Andover, Mass., and the Sheffield Scientific School of Yale University.

Classified Contents

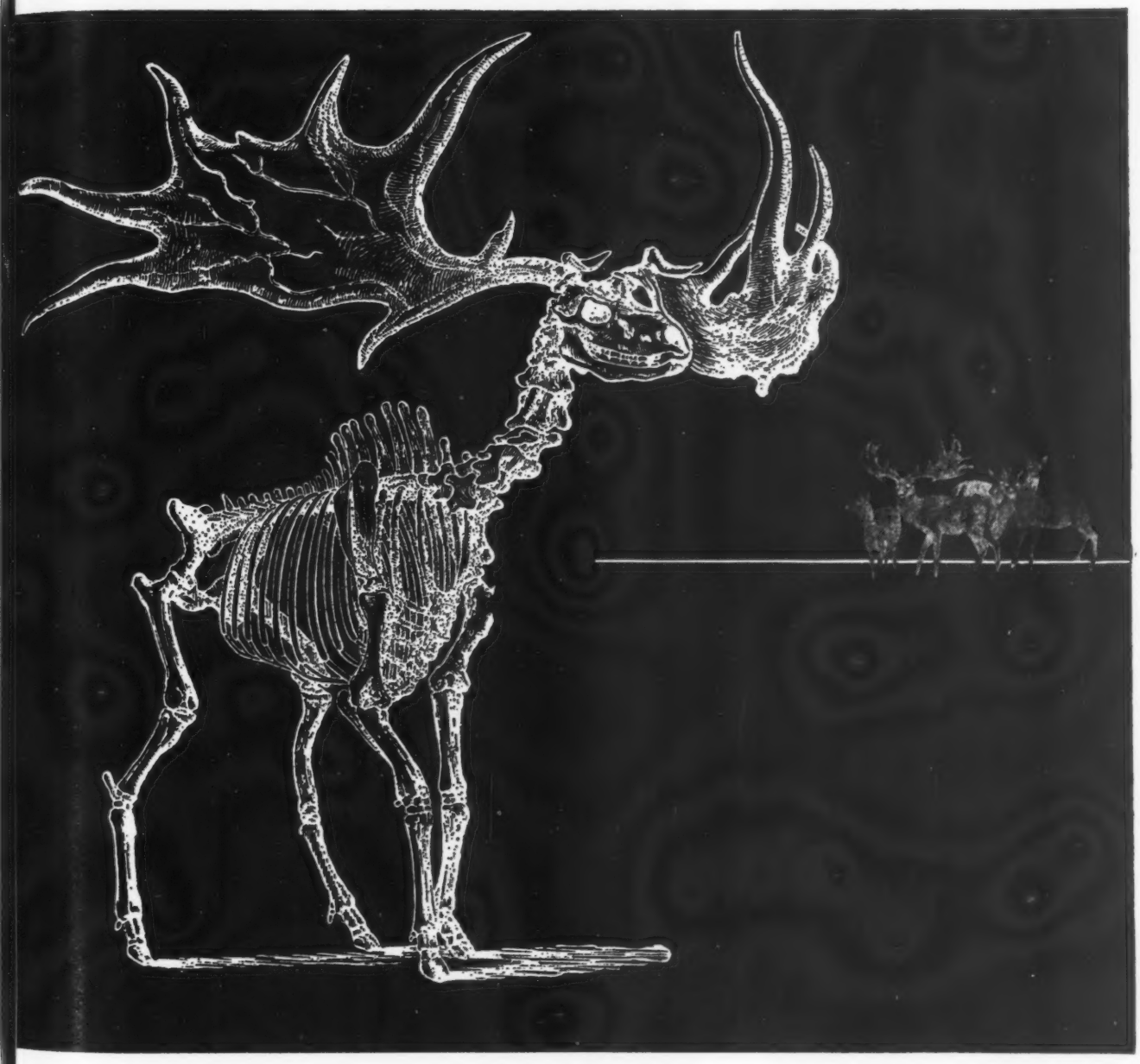
Your Progress Depends Upon Your Knowledge of Your Industry

THE ELK THAT ALSO RAN

Once upon a time an enormous elk with out-size antlers roamed the Irish forests. He was impressive but impractical; concentration of weight in the wrong place ruined his ability to meet competition.

The same thing can happen in modern machinery. Too much weight, especially in parts subject to rapid operation, can reduce efficiency considerably. The machine may not become extinct, but it won't make many friends.

There is a simple, economical way of avoiding such troubles—specifying molybdenum steels. Their hardenability permits weight reduction with no sacrifice in ability to meet service requirements. Practical data on request.

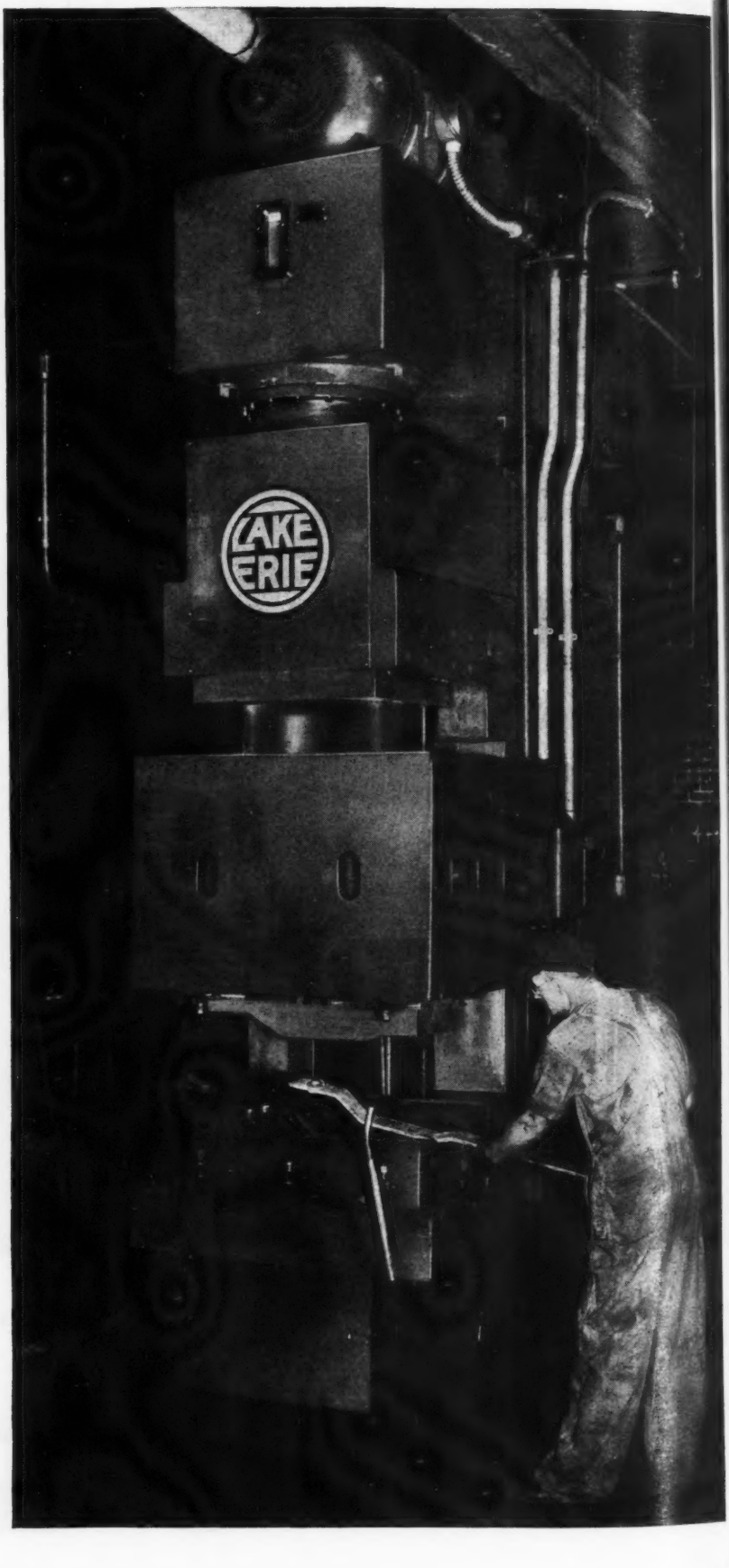


MOLYBDIC OXIDE—BRIQUETTED OR CANNED • FERROMOLYBDENUM • "CALCIUM MOLYBDATE"
CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.

Climax Molybdenum Company
500 Fifth Avenue · New York City

MOLY

International Harvester Co.



200-ton "C" Frame Lake Erie Hydraulic Press in operation in the McCormick Works of the International Harvester Company. Press has 35-ton cushion in bed. Lake Erie manufactures hydraulic presses in a wide range of standard sizes and types to meet almost every need. Special presses are quickly engineered to order when required. Bulletin illustrating and describing the various models now available may be had on request.

gets better production with LAKE ERIE Hydraulic Press

Forming frame member for International Harvester Binder in Lake Erie Hydraulic Press. The wide opening in this press is a well-liked feature as it permits ease of handling of the work and makes possible the fabrication of a wide range of sizes. This press has increased production and product quality for International Harvester.

The International Harvester Company—whose slogan is "Better Production for a Better Future"—is always alert for new and improved ways of doing things. The Lake Erie Hydraulic Press recently installed in the McCormick Works of the company provides a good example of the way in which International Harvester and its customers benefit from this policy.

In the production of frame members for binders, the Lake Erie Hydraulic Press is turning out about 200 parts per hour as compared with 100 to 125 parts per hour by the old method. In addition to greater production, the part itself is now of better quality as the metal is "set" by the squeezing action of the hydraulic press and dimensions and straightness are held to closer limits. In the manufacture of a transmission gear for a mower, the hydraulic press works to a tolerance of .004″ of final machined size as against about 1/16″ by the old method. To the saving in metal and machining is added a rate of production almost double that obtained heretofore. And there are numerous other jobs on which the new press is proving equally proficient.

Lake Erie Hydraulic Presses available today are introducing new economies in production in a wide range of industries. It will be worth your while to check up on the applications and advantages of these new, faster hydraulic presses for various phases of your production. An experienced Lake Erie Engineer will assist you, without obligation, if you desire.

● Leading manufacturer of hydraulic presses—all sizes and types—metal working...forging... metal extrusion... plastic molding... processing...rubber vulcanizing...stereotyping...special purpose.

LAKE ERIE
ENGINEERING CORP.
BUFFALO, N.Y. U.S.A.

LAKE ERIE ENGINEERING CORP.
MANUFACTURERS OF
HYDRAULIC PRESSES AND SPECIAL MACHINERY
General Offices and Plant:
170 Woodward Avenue, Buffalo 17, New York

★

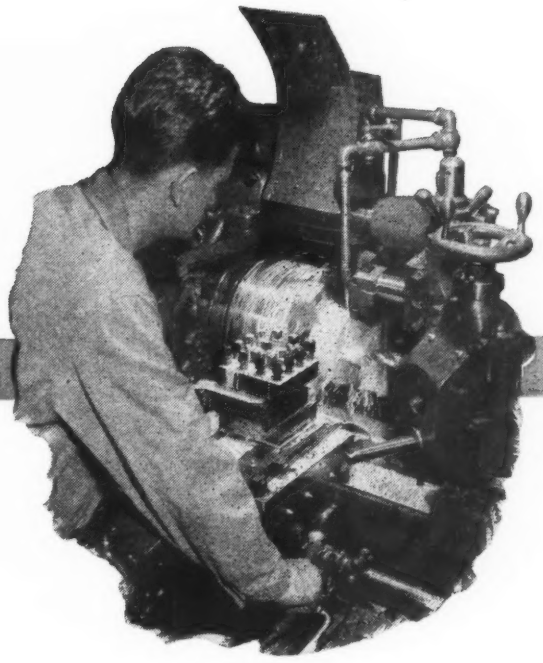
FELLER ENGINEERING DIVISION
SPECIALISTS—EXTRUSION AND
FORGING PRESSES
1100 Empire Building, Pittsburgh 22, Pennsylvania

OFFICES IN PRINCIPAL CITIES AND FOREIGN COUNTRIES

TODAY'S "BARGAIN"...

A dollar's worth of production

for $1.35



THAT'S another way of saying that the cost of producing one unit in the metal turning industry has increased over 35% since 1939.

For now it costs $1.35, for the *same* machine, operated by the *same* man, to produce the *same* volume that seven years ago cost only $1.00.

Manufacturers must realize that to combat this rise in material, labor and overhead costs they must either raise prices (with the subsequent danger of pricing themselves out of the market) or boost production.

One way to step up output is clearly defined. With over half the machine tools used in private industry 10 years old, or older, much can be done to improve machine tool efficiency. Your nearest Warner & Swasey field engineer can suggest ways for doing this in your plant, either through new accessories, improved tooling set-ups or by replacing obsolete machines with new Warner & Swasey Turret Lathes or Multiple Spindle Automatics.

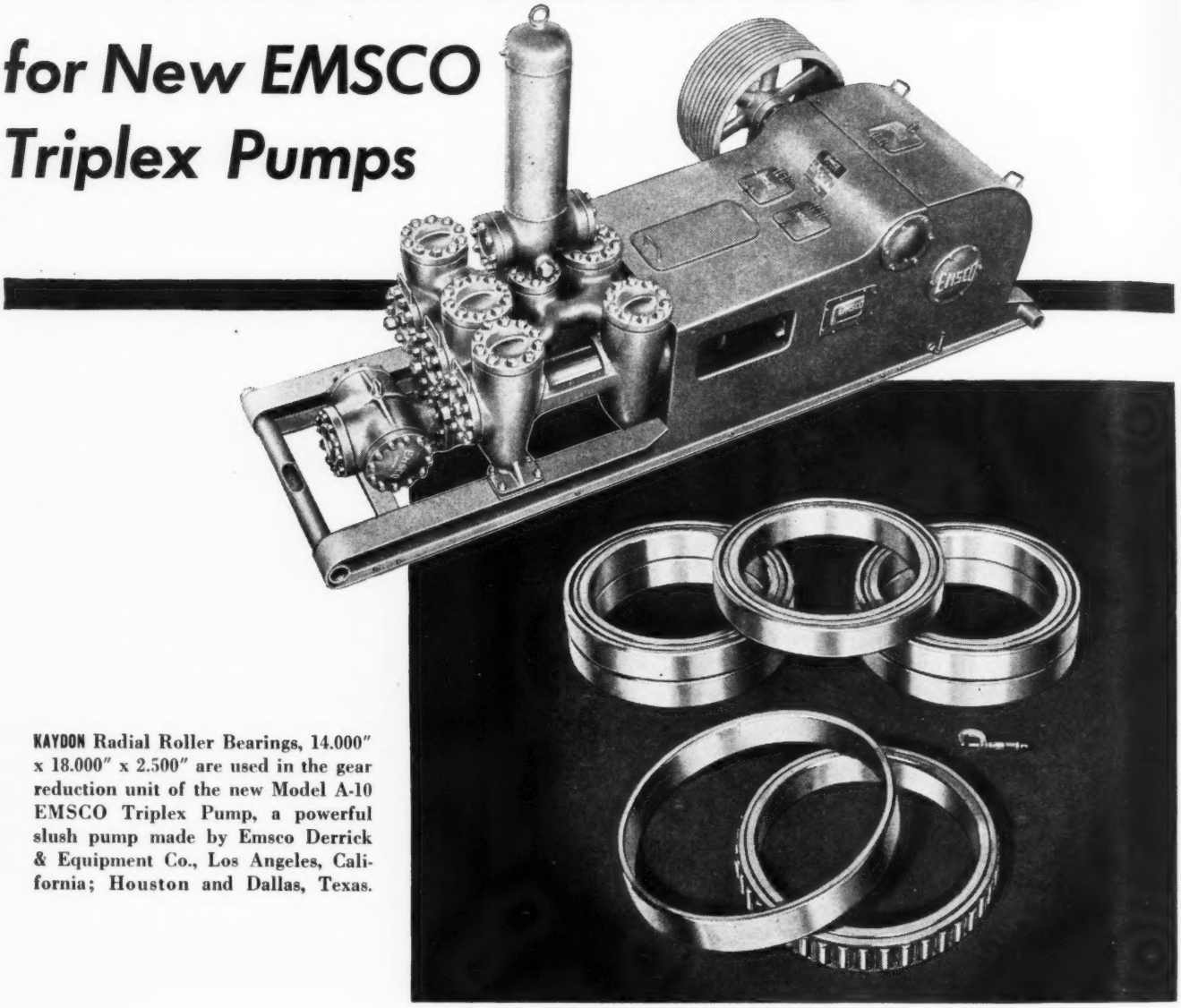
WARNER
&
SWASEY
Machine Tools
Cleveland, Ohio
U. S. A.

You can machine it better, faster, for less...
with a Warner & Swasey

TURRET LATHES, MULTIPLE SPINDLE AUTOMATICS, PRECISION TAPPING & THREADING MACHINES

KAYDON BEARINGS OK'd

for New EMSCO Triplex Pumps



KAYDON Radial Roller Bearings, 14.000" x 18.000" x 2.500" are used in the gear reduction unit of the new Model A-10 EMSCO Triplex Pump, a powerful slush pump made by Emsco Derrick & Equipment Co., Los Angeles, California; Houston and Dallas, Texas.

Oil field operators know EMSCO Slush Pumps for their fine engineering design, that results in big savings in weight, higher horsepower capacity per unit of weight, greater strength, and dependable performance.

KAYDON Bearings, precision-built and rugged, fit right into the sound engineering policies that have made modern EMSCO machinery so successful.

Similarly, in other fields of heavy-duty machinery, **KAYDON** Bearings are helping designers add outstanding advantages. Huge precision grinders, steel mill equipment, paper mill machinery, road-building units, excavators, hoists, crushers, bending machines and other heavy-duty equipment are serving industry better because of **KAYDON** Bearings.

* * *

Capacity now available for all types and sizes of **KAYDON** Bearings . . . standard or special. A confidential discussion of your problems may point the way to opportunities through use of **KAYDON** Bearings.

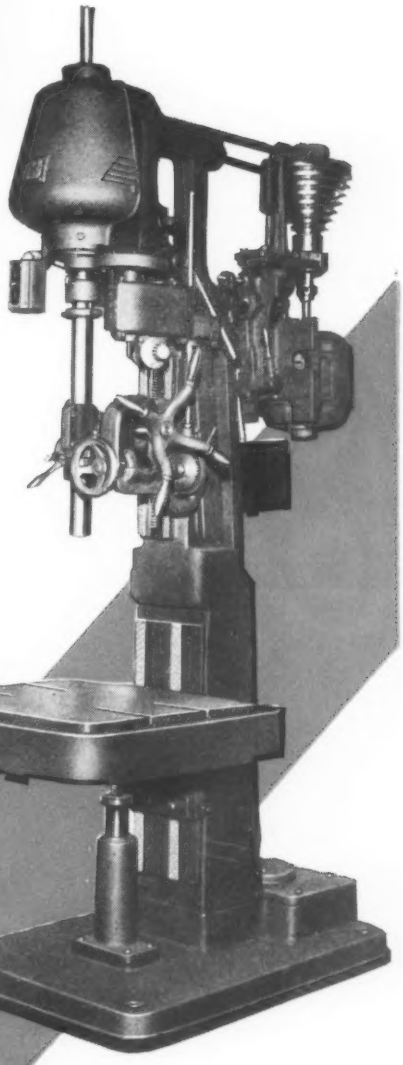
KAYDON *Types of Standard or Special Bearings:*
Spherical Roller • Taper Roller • Ball Radial
Ball Thrust • Roller Radial • Roller Thrust

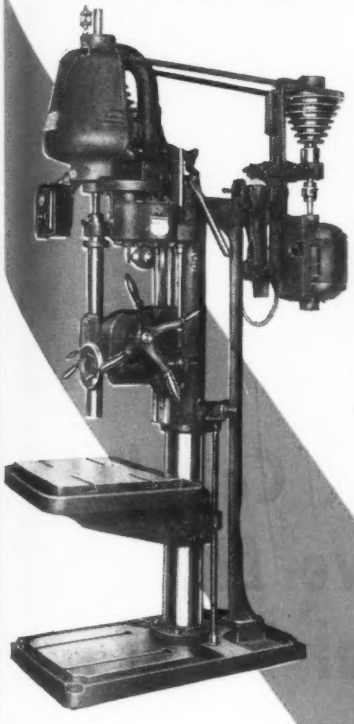
THE KAYDON ENGINEERING CORP., MUSKEGON, MICH.

All types of Ball and Roller Bearings 4" bore to 120" outside diameter

Built Right!

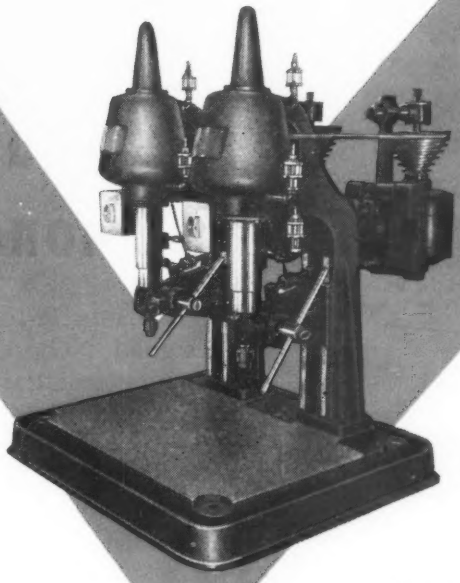
Like an athlete, a CANEDY-OTTO Drill press is stripped for fast, precision performance — no gadgets, no superfluous and costly attachments. Our 53 years experience as specialists in drill press design assure you that each unit is BUILT RIGHT — an advanced design, quality built for low-cost, accurate, high speed production. Fill all your drill press requirements from the World's Most Complete Drill Press Line — the Canedy-Otto line.





21" BOX COLUMN FLOOR DRILL

1½" capacity, available in one through six spindle models, of full ball and Timken roller bearing design. High alloy steel, heat treated spindle, with positive geared motor and automatic stop for predetermined depth drilling. Also operates through lever power feed or worm wheel feed. Eight step Vee belt drive on tilting motor bracket gives sixteen spindle speeds. Table, column and base of semi-steel casting, finished and normalized.



21" SLIDING HEAD FLOOR DRILL

1½" Capacity, 16-32 speed, single spindle model. Solid one-piece semi-steel cast frame with machined and integrally cast ways for movement of sliding head and table. Full floating spindle pulley. Spindle of heat-treated, high alloy steel, multi-splined. Available with Vee belt drive, back gear and power feed. Entire motor assembly mounted on famous C-O tilting bracket.

16" NO. 5-10,000 B.V. BENCH DRILL

A six speed, super-sensitive, high speed drill press available in 5/16"-3/8" capacity — floor or bench models — with one through six spindles. Ball bearing mounted, full floating spindle. Semi-steel cast column, frame, table and base. Motor unit mounted in famous C-O tilting bracket.

CANEDY-OTTO MFG. CO.

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